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Methods for Vitalizing the Study and Teaching of General Science[1]

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Two great forward steps have been taken in the education of boys and girls in our schools of today. Through an urgent demand for democracy in education, more earnest efforts have been made to meet the needs of the overwhelming majority, the millions of school children, whose training, either from choice or necessity, has been cut off at an early period. Secondly, a better understanding of the biological and psychological factors of mental development, has helped to flood every darkened corner of the class room with the light of a benign humanizing influence.

The phenomenal growth of the Intermediate School during the past few years, is convincing evidence that earnest and successful efforts have been made to meet some of these needs. From the educational wreckage of the past, the lives of thousands of boys and girls will be salvaged to a higher purpose and greater usefulness. In his monumental work, "The Principles of Secondary Education," Alexander Inglis of Harvard University, recommends the following organization for the eighth and ninth grades of the Intermediate Schools.

GRADE VIII

Required Subjects or Constants	Periods per week
English	5
History and Civics	5
General Science	4
Mathematics	4
Physical Education	2
Total	20
Variables	10

GRADE IX

Required Subjects or Constants	Periods per week
English	5
Community Civics	4
General Science	4
Physical Education	2
Total	15
Variables	15

1 Delivered at conferences in General Science conducted by Mr. Lunt in Washington, D. C., April 19—20, 1921.

Note: Variables, or electives consist of foreign languages, mathematics, fine arts, history, commercial studies, domestic studies, music and clerical studies.

In this curriculum organization general science is listed as a required subject in both the eight and ninth grades, because its offers fundamental, universal and direct educational values.

Let us first consider some of the fundamental aims of general science. According to Professor Inglis, general science provides opportunity for acquaintance by pupils, with the facts, principles and processes of natural phenomena in such a way as to furnish them with some understanding of the elementary laws of nature which are necessary for healthy, intelligent and efficient living. David Snedden of Teachers College, Columbia University, says, "The primary purpose of general science for youths of 12 to 16 is to explain and interpret by means of general and vivid experience, the important facts of accessible natural phenomena and of significant and easily comprehended applications of science to human well being.

During the past ten years at the English High School of Boston, we have tried to develop the general science courses with three fundamentals aims constantly in mind. Our foremost aim has always been to improve living conditions. With this in view, a careful study of home environments has been carried on, especially throughout the crowded tenement house districts of the city. Many opportunities for friendly visits to the homes of our boys have been afforded, making it possible for us to study, at first hand, actual living conditions. Adequate appreciation of some of these conditions can be gained only by actual contact with them. They afford a fertile field for welfare workers and Health Boards. In general, we found small rooms, often crowded; poorly ventilated; characterized by a moldy odor; with little or no sunlight; flies and other vermin; exposed food and dirty dishes on tables; piles of rubbish; ill smelling toilets; black ceilings; leaking faucets; open gas burners; fire traps; and many anaemic children. Through our general science work in the schools we have constantly endeavored to improve some of these conditions. In this work we have always received unfailing cooperation from the Health Commissioners.

Our second aim in the development of general science courses has been to foster appreciation; to keep alive the sacred spark of wonder in the child's mind, not by dogmatic instruction on trivial things, but by realistic demonstrations of a few of the wonderful scientific contributions to human welfare. During the past year the science clubs gave a musical concert by the wireless telephone to the entire school. They set up an arc receiving set and listened to the International News coming direct from the P. O. L. station at Nauen, Germany. A miniature lighting plant was constructed. This included a water turbine attached to the faucet. A small K. & D. Generator, a central power plant with fuses and rheostat, line wires on small poles, imitation transformer, and a house model with switches, meter, fuse blocks and miniature electric lamps. Other inspirational projects included the construction of a small gas plant, taking pictures and developing them, fire kindling contests, operating gasoline and steam engines, and the study of stars and constellations at night. In all these projects the primary purpose has been inspiration rather than information.

The third great aim is embodied in the methods, the social experimental method. This will be discussed later.

What to teach in General Science. Here our choice should be made on the basis of the pupil and his needs. Actual, vital, functioning natural phenomena and processes are most worth while. These lead to a control of the environment and to an appreciation of the beauty and wonders of the every day phenomena of living. Many persons have never experienced the thrill of watching the blazing logs in camp or in the fire place at home. To these people the kitchen coal range is an object of little interest, while dish washing and sifting ashes is drudgery. General science should aim to endow such simple tasks as these with a pride and dignity of performance. In this way it will contribute much not only for efficiency, but also to the peace and joy of home life.

The arrangement of general science courses into teaching units is generally accepted as the best, for it assures a more thorough and practical development. We believe that some of the most valuable teaching units are the following:

1. The food we eat.
2. The air we breathe.
3. The water we drink.
4. Weather and its changes.
5. A study of fire.
6. Heating our homes.
7. Lighting our homes.
8. Electricity in our homes.
9. How our homes are built.
10. The home garden.
11. The clothes we wear.
12. Keeping well.
13. Life and where it comes from.

Each unit is developed by a series of so-called projects, arranged in natural and psychological order. To illustrate: Unit 5. A Study of Fire may be developed by the following projects

1. How to operate the coal range.
2. How to kindle a fire.
3. The draught and how it works.
4. How to make a fire burn fast.
5. How to check a fire.
6. What becomes of wood when it burns.
7. How coal burns.
8. How to put out a fire.

The development of each project depends upon several experiments. In this the sequence must also be psychological to fit the pupil's mind. Each experiment is a stepping stone to the next. This is a building up process, leading naturally and vividly to a final comprehension of the principles involved. To illustrate: Project 3. The draught and how it works, may be developed as follows:

First: An experiment to show that air expands when heated.

Second: An experiment to show that cold air is heavier than warm air.

Third: An experiment to show the circulation of air currents.

Whenever possible the experience should preceed the experiment. For the experiment is simply a means to vivify the experience and to help interpret it. Before attempting to show how the draught works, pupils should be given instructions to study the draught in the kitchen coal range or heater at home.

The statement of the question, what causes the draught? comes next as a challenge to the pupil. His curiosity and interest is aroused. A condition of mental strain or perplexity is developed. The experiment is then introduced to vivify the experience and to help the pupil discover the scientific principles involved.

The most wonderful opportunities of general science may be realized through the methods it offers. At English High School we have developed what we call "The Social Experimental Methods." The boys themselves take turns in demonstrating experiments before the class. The amount of interest and enthusiasm aroused is remarkable. It is difficult to keep the boys in their seats. In fact, we make no attempt to do so. We let them crowd around the demonstration to watch what is going on. Pedantic and artificial rules of class room decorum are cast aside. Instead we have a group of eager young scientists trying to discover some of the great natural laws that govern their own welfare. Of course, the teacher must constantly give directions and cautions. Some pupil may volunteer to show what water is composed of. When he has never seen a Hoffman's apparatus. He follows the teacher's directions. Nor does this seem to detract from the credit he receives from his classmates. In performing the experiment the boy experiences the same thrill that comes to a man when he first takes the wheel of his car from the instructor and tries to operate it.

The function of the teacher is to lead the discussion, to ask questions, to challenge the observations and reasoning of his class. These questions should be pertinent, to the point, and should lead gradually to a final comprehension of the principles illustrated by the experiment.

The Social Experimental Method assures 100 per cent attention and participation. The entire class is watching and thinking. Nor is this thinking imitative. It is creative—the thinking of an inventor. With proper psychological development the pupil will grasp for himself, many of the laws and principles of natural phenomena with no explanation from the teacher. Here in lies some of the remarkable possibilities of this method. For, if we take a class of only 20 pupils with an average age of 15 years and give each pupil credit for only 5 years of potential experience—the sum total of potential experience for the entire

class is 100 years. This aggregate potential experience is a great reservoir from which the teacher may draw, of course, much of this experience is superficial and disorganized. It is the teacher's duty however to organize it and to draw from it the truths he seeks. For the unspoiled attitude of childhood, marked by ardent curiosity, fertile imagination and love of experimental inquiry is his, to mold and shape.

Moreover the social experimental method is essentially democratic. Every pupil is given an equal opportunity to participate. This leads to self activity, develops initiative, and fosters the habits of careful observations and reasoning.

This class room procedure is supplemented by Individual or Home Projects. Each pupil is required to carry on several of- and special credit is given for this work. These home projects are planned largely for the purpose of putting into actual practice the science learned in the class room. The pupil is allowed to choose from a long list of suggested projects those that interest him most. A few of these are as follows:

Taking care of the kitchen coal range.
Operating the home heating plant.
Repairing leaks in plumbing.
Making the home sanitary.
Taking pictures.
Planting a home garden.
Caring for fruit trees.
Fixing the Electric Bell System.
Improving the ventilation.
Removing fire hazards.
Substituting mantle gas lamps for open burners.
Cleaning and adjusting the gas range burners.
Reading the meter.
Destroying rats and harmful insects.
Improved habits of eating and sleeping.
Caring for the teeth.
Home wireless.
Night study of planets and stars.
Care and operation of automobiles.
Making kites, boats, aeroplanes, etc.
Operating toy motors, dynamos, steam engines, etc.

In working out these projects the boys are allowed to use clippings from papers and magazines. Reference books are also of great value. Every school should have a library of science books—books of invention, adventure, discovery, lives of great scientists, etc.—These should be simple and appealing to the imaginative minds of youth.

When these home projects are completed they are submitted in the form of pamphlets or small booklets. Special credit is given for neatness, arrangement and originality. The class experiments are also carefully written up by the boy. Here too his interest is in evidence, for he frequently spends considerable time on elaborate sketches and detailed description. This part of the boy's task is made constructive. He does not write up his science lessons primarily for the teacher's scrutiny. He is compiling an original science book of his own. For all the papers are kept, and returned to the boy at the end of the year. He arranges these and makes an index. They are then sent to a bindery and bound similar to a real book. This is presented to the boy as a permanent record of his own achievements.

During the past 8 years each general science class has been organized into a club. They elect officers and conduct a brief meeting once each week. We consider these clubs of great value. They help to foster a true spirit of democracy and cooperation. The boys seem to appreciate the added responsibilities of governing themselves, and helping to plan the work in science.

They provide many interesting programs during the year. Outside lecturers are sometimes secured, but usually the members of each club volunteer to perform experiments and demonstrations. During the present year the science clubs have offered prizes for Boy Scout contests, original demonstrations and best books. They gave a musical concert by wireless telephone to the entire school. They presented a gasoline marine engine with full equipment to the science department. They are now planning an annual outing for May 30.

When general science functions in service to the home and community its greatest value is accomplished. Specialized science training has failed in this important mission. The minds of children have been filled with half digested formulas and theories. Page after page of text books have been memorized under the guise of learning. The schools must seek not in books, but in life those things in science most worth teaching. They must inquire first into the needs of the child and second into the needs of the community in which the child lives.

The aims and purposes should be far reaching. Production should be stimulated by real training in annual husbandry and agriculture. Economy and efficiency in the home should be

increased through a practical knowledge of sanitation, food, clothing, lighting and heating. Close cooperation should be maintained with Boards of Health for the demonstration of disease and pestilence. These great needs can be met, not by the superficial and fragmentary offerings of the text book, but rather by a thorough and careful study of actual living conditions.

Thus general science must assure great responsibilities. It must elevate standards of living, stimulate production, train in economy and guard against disease. In short, it must train our boys and girls to live better, cleaner and more useful lives. It must prepare them to perform more efficiently their future duties as mothers, fathers and citizens.

The greatest message that general science offers for educational emancipation, is embodied in its methods. For it recognizes the native interests and the natural development of the child.

The so-called project method of science teaching is one of the biggest steps forward in the educational achievements of this century. It deals with reality, real objects and real phenomena. It is the method by which in life we gain our most lasting and valuable knowledge. Education becomes a true leading out process in place of product, a training of functioning power and creative thinking in place of repetition and servile imitation. The wonderful spirit of discovery and invention stimulates the child's mind to its highest possibilities of growth. All the great inventions and discoveries of applied science have come through the application of these same habits of observation and inference. The innumerable blessings that contribute so much to the comforts and conveniences of modern civilization have all been realized through the creative thinking of an Edison, a Pasteur or a Bell.

Thus general science must play the part of the emancipator in the new education. It must free our schools from the bondage of books. It must substitute reality for artificiality, functioning powers for oriental memory training and creative thinking for servile imitation. It must teach the common things to common men. Then every school will have a voice and will say:

I teach!
The earth and soil
To them that toil
The hill and fen
To common men
That live right here.

The plants that grow
The winds that blow
The streams that run
In rain and sun
Throughout the year.

And then I lead
Thro wood and mead
Thro mold and sod
Out unto God
I teach!

General Science in Minnesota: Outline of Course

Report of the General Science Committee at the High School Conference held at the University of Minnesota, March 1921.

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I. FOREWORD

The purpose of this report is to furnish help to the teachers of general science in Minnesota. One of the main difficulties in teaching the subject is lack of proper organization. The report suggests a possible basis that may help the teacher and may aid in answering the criticism that the subject is a meaningless mass of unrelated topics. The report is intended to be merely suggestive. The committee does not expect that any teacher will attempt to follow exactly the outline and suggestions given nor that all the ground suggested can be covered in one year. More than can be covered is purposely given so as to allow a larger range of choice. If the report shall assist general science instructors in any way to improve their teaching, it will have served its purpose.

COMMITTEE

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II. GENERAL SCIENCE SITUATION IN MINNESOTA.

Data on the general science situation in the state have been obtained from the annual reports of the State High School In-

spector and from information kindly furnished by the State Department of Education regarding the enrollment for 1920. As a basis for comparison, figures are given also for the special sciences. The following table shows for the years 1915 and 1920 the number of students and of schools pursuing each of the sciences.

Table showing changes in science enrollment in Minnesota for the five year period from 1915 to 1920. (* indicates gain, – indicates loss).

	Total Number Students		Percent of total enrollment		Percent of gain or loss in 5 yrs	Total number schools		Percent of all schools		Per cent of gain or loss in 5 yrs
Subject	1915	1920	1915	1920		1915	1920	1915	1920	
General Science	458	5684	1.2	11.5	*858.3	17	121	8.	50.	*525
Biology	675	889	1.7	1.8	* 6.	15	21	7.	8.7	* 24.3
Chemistry	4293	4790	11.	9.7	– 11.8	156	169	70.6	70.4	– 0.3
Physiology	3095	3082	7.5	6.3	– 16.	120	121	54.	50.	– 9.2
Physics	3865	3835	10.	7.8	– 22	149	158	67.	65.8	– 1.7
Botany	3981	3072	10.	6.2.	– 38	137	112	62.	42.5	– 31.4
Physical Geography	3264	2092	8.	4.2	– 47.5	114	91	51.	37.9	– 25.7
Zoology	2275	1450	6.	2.9	– 52	88	66	40.	27.5	– 31.2
Total in State	39520	49060	Percent gain 24.1			221	240	Percent gain 7.9		

From this table two comparisons can be made, one of different sciences with each other and another of the same science at different dates. The most conspicuous feature shown is the phenomenal growth of general science. During the last five years the number of schools offering the subject has increased over sevenfold and the number of students enrolled, twelve fold. In 1920 more students were enrolled, twelve fold. In 1920 more students were enrolled in the subject than in any other science. These figures are especially interesting when compared with those for the special sciences. The only other science which has gained is biology, which may be called one kind of general science. Every special science has lost in the per cent of both students and schools pursuing the subject.

Furthermore every special science (excepting chemistry) has lost not only in the per cent of students enrolled but also in the actual numbers, notwithstanding the fact that during the same period the number of high schools in the state increased 7.9 per cent and the number of students 24.1 per cent. This loss is especially marked in the case of botany, zoology, and physical geography, which show a loss in the total number of schools in which they are being taught.

These figures indicate that a splendid opportunity exists for general science to show its possibilities. It is being given a fair trial. The success or failure of the subject depends to a large

extent upon the teachers of the subject. The committee which prepared this report has a firm conviction that general science has such lasting value as to entitle it to a permanent place in our schools. This report has been prepared in the hope that it may aid the teachers in Minnesota in proving more fully the great educational value of the subject.

III. Aims of General Science Teaching

The main objectives of secondary education have been outlined by the Commission on the Reorganization of Secondary Education, appointed by the National Educational Association. These objectives were adopted by a Science Commission appointed during the war to prepare a report on the teaching of science in secondary schools in the war emergency. These objectives were adopted also by the Science Committee appointed as a sub-committee of the Commission on the Reorganization of Secondary Education, whose report has been issued by the Bureau of Education as Bulletin, 1920, No. 26.

It seems wise to your committee to adopt these objectives for two reasons: first, because they appeal to the committee as an excellent statement of guiding principles, and second because they represent the consensus of opinion of many leading educators.

Following is the list of objectives as adopted by these commissions: (1) health of the individual and the community; (2) worth home membership; (3) citizenship in a democracy; (4) worthy use of leisure; (5) vocational guidance and preparation; (6) ethical character.

IV. Organization of General Science

General Science should be organized with reference to the environment and every day life of the child. In accordance with this thought the following principles are suggested as guides in the organization of general science:

1. The basis for the organization should be found in human life, not in the subject matter.

2. This life should be that of the pupil, not that of the teacher.

3. This should be the pupil's present life, not his future adulthood.

V. Outline of General Science

I. Science of the Home.

1. Science of the household.
   - A. Hygiene of the home.
     - a. Water supply. b. Disposal of waste. c. Lighting.
     - d. Heating and ventilating. e. Insect pests.
     - f. Food (preparation, preservation, care, uses).
     - g. Cleanliness.
       - 1. Soap, washing machines; 2. Electric iron; 3. Vacuum cleaner.
   - B. Building the home (wood, bricks, cement).
   - C. Protection from fire.
   - D. Electricity in the home.
   - E. Labor saving devices.
   - F. Recreation.
     - a. Musical instrument. b. Singing. c. Electric toys.

2. The home grounds.
   - A. Gardening.
     - a. Ornamental (flowers, shrubs, vines).
     - b. Vegetable and fruit gardens.
       - 1. Weeds and insect pests.
       - 2. Bird and insect friends.
   - B. Poultry keeping.
   - C. Bee keeping.
   - D. Recreation.
     - a. Taking pictures. b. Star study. c. Bird study.
     - d. Outdoor toys (kite, waterwheel, windmill, bow and arrow).

II. Science of the School.

1. Hygiene of the school.
   - A. Water supply. B. Heating and ventilating.
   - C. Lighting. D. Care of children's health.
   - E. School lunch.

2. Recreation.
   A. Playground apparatus. B. Athletics. C. Exercise.

3. Electricity in the school.

4. Vocational guidance.

III. Science of the Community.

1. Transportation.
   A. By land.
      a. Automobile. b. Locomotive. c. Trolley.
   B. By air.
      a. Airplane. b. Airship.
   C. By water.
      a. Sailboat. b. Steamboat. c. Submarine.
2. Communication.
   A. Telegraph.
   B. Telephone.
   C. Newspaper—the printing press.

3. The health of the community.
   A. Public water, milk, and food supplies.
   B. Disposal of waste.
   C. Insects and disease.
   D. Contagious diseases.
   E. Health officers.

4. Weather and climate.

5. Solar system.

6. Forces of nature.
   A. Water. B. Glaciers. C. Wind.

7. Sources of power.
   A. Water. B. Steam. C. Electricity. D. Gasoline.

8. Natural resources.
   A. Wild animals.
   B. Mines.

C. Forests and shade trees.
  a. Birds. b. Fishes. c. Fur-bearers.

9. Community recreation.
  A. Moving pictures.
  B. Parks and playgrounds.
  C. Skating and coasting.

10. Safeguarding life and property.
  A. Lighting the streets.
  B. Fire protection.
  C. Cleaning the streets.

VI. DETAILED OUTLINE OF A FEW TOPICS.

Topic 1. *Protection of home from fire.*

A. Harm done by fires.
  a. Materials burned.
  b. Money loss.
  c. People killed and injured.

B. Causes of fires.

C. Remedies.
  a. Carefulness in use of matches, lamps, stoves, kerosene, gas, and gasoline.
  b. City fire department.
  c. Fire extinguishers.

Topic 2. *Lighting the home.*

A. Early lamps.

B. Candle.
  a. Study of flame (color, temperature).
  b. Need of air. (experiment)

C. Kerosene lamps.
  a. How different from early lamps.
  b. Use of burner.
  c. Use of chimney.

D. Petroleum.

a. Where found.
b. How obtained from wells.
c. Distillation products.
d. Increased demand in recent years.

E. Gasoline lamps.

a. Construction of lamp.
b. Mantle.
c. Danger in careless handling.
d. How tested.

F. Gas lights.

a. Comparison with gasoline lights.
b. Gas meter.
(1) Construction. (2) Reading.

G. Acetylene lights.

a. How acetylene is produced.
b. Prest-o-lite.

H. Electric lights.

a. How different from kerosene.
b. How similar to gas with mantle.
c. Different kinds of filaments.
d. Nitrogen lamps.
e Reading meter.

I. Lighting a room.

a. Intensity.
b. Diffused light.
c. Distribution of light.

J. Cost of lighting.

a. Kerosene.
b. Illluminating gas.
c. Acetylene.
d. Electricity.

Topic 3. *Heating.*

A. Causes or sources of heat.

a. Sun, friction, oxidation, electricity.

b. Fuels—coal, wood, gas, oils.

B. Effects of heat.

a. Change in state.

b. Expansion.

c. Uses.

(1) Refrigeration.

(2) Ventilation and ventilating systems.

C. Transference of heat.

a. Convection, radiation, conduction.

D. Application of principles.

a. Heating systems.

(1) Stove, hot air and pipless furnce, steam, hot water.

b. Other uses.

(1) Fireless cooker, thermos bottle, electric appliances.

Topic 4. *Weeds of the Garden.*

A. Harm done.

a. Decrease yield.

b. Increase labor.

c. Harbor pests.

d. Poisonous weeds.

B. Classification.

C. Characters of weed seeds.
- a. Large numbers borne on one plant.
- b. Adaptation for seed dispersal.
- c. Vitality of weed seeds.

D. Control of weeds.
- a. Control by birds.
- b. Control by man.
  - (1) Keeps weed seeds out.
  - (2) Destroys weeds.
    - (A) Cultivation. (B) Mowing (C) Smothering. (D) Spraying.
  - (3) Rotation of crops.
  - (4) Weed laws.

Topic 5. *The water supply.*

A. Pure water.
- a. What is it?
- b. Sources—rain—how formed—keeping and collecting—dangers.
- c. Springs—how formed, ground water, flowing wells, artesian wells.
- d. Cisterns, good and bad.
- e. Wells and pumps—dangers.
- f. Streams and lakes—dangers and good points.

B. Impure water.
- a. What is it?
- b. Sources of danger in water supply.
- c. Germs and disease.
- d. Purification of home water supply.
- e. Uses of water in the home.

C. How we get water into our homes.
- a. Water pressure and air pressure.
- b. Pumps and how they work, force pumps.
- c. Pneumatic tank system.
- d. Faucets, mechanism of, how to prevent leaking.

VII. LIST OF BOOKS FOR CLASS USE.

1. *Textbooks.*

Barber. First Course in General Science. H. Holt.
Caldwell and Eikenberry. General Science. Ginn.
Smith and Jewett. Introduction to Study of Science. Macmillan.
Van Buskirk and Smith. The Science of Everyday Life. Houghton Mifflin.

2. *Reference Books.*

Bailey. Manual of Gardening. Macmillan.
Baynes. Wild Bird Guests. E. P. Dutton.
Coleman. The People's Health. Macmillan.
Conn. Bacteria, Yeasts, and Molds in the Home. Ginn.
Darrow. The Boy's Own Book of Great Inventions. Macmillan.
Doane. Insects and Disease. H. Holt.
Fisher and Fisk. How to Live. Funk and Wagnalls.
Forman. Stories of Useful Inventions. Century Co.
Going. Our Field and Forest Trees. A. C. McClurg.
Johnson. Modern Inventions. F. A. Stokes.
Maule. Boy's Book of New Inventions. Grosset and Dunlap.
Milton. Children's Book of Stars. Macmillan.
Williams. How it Works. T. Nelson and Sons.
Verrill. The ABC of Automobile Driving. Harper Bros.

VIII. LABORATORY AND FIELD PROJECTS.

One problem of the small high school is the matter of facilities for laboratory work as regards both the expense involved and room for doing the work. With these schools especially in mind the committee has prepared the following lists of exercises. For the first set no laboratory facilities of any kind are required because the work is done chiefly outside of the school building. Besides effecting a saving of expense, this type of work has the further advantage that it represents the best kind that can be done because it connects the activities of school with those of the home and community.

A second set of exercises is given which may be performed in the school room and which require only the simplest apparatus, such as may be obtained from the pupil's homes or from the school equipment usually provided for the work in the other

sciences. These projects may be performed either as demonstrations or as individual laboratory exercises.

LIST I. PROJECTS REQUIRING NO LABORATORY FACILITIES.

A. *Home Projects.*

1. To make a study of the heating system used in the home.
2. To learn if the home is properly ventilated.
3. To make a ventilating screen.
4. To read the meter (gas, electric, or water) and compute the cost.
5. To distinguish fresh from stale eggs.
6. To study the parts of an electric door-bell outfit and to repair it if it gets out of order.
7. To remove fire hazards from the home.
8. To study the mechanism of the piano.
9. To make a home laboratory.
10. To see how much water is wasted from dripping faucets.
11. To beautify the home by means of house plants.
12. To raise a Chinese lily for a Christmas present.
13. To become a landscape gardener for the home grounds.
14. To plant bulbs in the home yard so as to get flowers in the spring.
15. To raise vegetables in the home garden.
16. To test different varieties of some one kind of vegetable.
17. To make a nesting box for birds to put in the home yard.
18. To feed the winter birds.
19. To name the common constellations of stars.

B. *School Projects.*

1. To form a League of Modern Health Crusaders.
2. To put up nesting houses for birds in the school yard.
3. To make the school room attractive by means of house plants.
4. To make an exhibit of leaves of trees, to which the friends of the students may be invited.
5. To see if the ventilating system of the school furnishes the essentials of proper ventilation.
6. To form a bird club.

C. *Community Projects.*

1. To investigate local conditions with reference to water, milk, and food.
2. To see what the class can do to help rid the locality of mosquitoes.
3. To learn what the class can do to help control the fly nuisance.
4. To do something to protect the valuable birds found in the locality.
5. To see if the shade trees of the town are properly cared for.

D. *Field Projects.*

1. To study those vines and shrubs that are adapted for growing in the home grounds.
2. To identify some of the cultivated flowers and to note their attractive features.
3. To identify and make a collection of the most common weeds found in the vegetable garden.
4. To learn what beneficial birds are common in the locality.
5. To visit the central telephone office.
6. To be able to name the common shade trees growing in town.
7. To visit a moving picture theatre to see how the projecting apparatus works.
8. To visit a garage to study the parts of an automobile.
9. To visit a fire engine house.

LIST II. DEMONSTRATION OR LABORATORY PROJECTS REQUIRING ONLY THE SIMPLEST APPARATUS.

1. To study the burning of wood, soft coal, and hard coal.
2. To compare safety matches with ordinary matches.
3. To study the burning of a candle.
4. To find out what conditions are needed for a candle to burn.
5. To study the principles applied in the hot air furnace.
6. To learn how the air we breathe out differs from the air we breathe in.
7. To show that air has weight and hence exerts pressure.
8. To study the action of yeast and baking powder.
9. To study the principles involved in freezing ice cream.
10. To learn the effects of soap on hard water.

11. To make a plan of a vegetable garden.
12. To study the life history of the mosquito.
13. To study the action of the compass and the magnet.
14. To learn why a boat floats.
15. To show the construction and use of the camera.
16. To show the effect of Pasteurization on the keeping quality of milk.
17. To find out what nutrients are in the foods commonly used in the home.
18. To plan economical buying of food for the family for one week.

The Pupil's Interest as a Foundation in Science Teaching

M. C. Collister, Utica Free Academy, New York.

The past twenty-five years have witnessed a phenomenal growth in the enrollment in the higher institutions of learning in the United States. This growth in the Secondary Schools alone, to say nothing of the growth in the colleges, would be not less than 700 percent. Along with this excessive increase in registration, has come a similar expansion in their curricula.

Back in the early years of the high school, its chief aim was to train young people for college. The boy or girl who did not contemplate higher education was not expected to continue his studies beyond the course offered in the grade school.

Today, we find that this same high school has had its functions greatly multiplied; for its body of students is cosmopolitan from whatever angle we attempt to view it. When we study their plans for life work we find that comparatively few expect to have an opportunity for a college course. The time has come when many of our pupils do not plan to leave school to take up their life work until they have completed one or more years of the high school course. Yet in many of our high schools of today this class of students is required to go in the straight and narrow way of the college preparation.

It is fitting that the colleges should dominate the work given in the high school when they are to receive the product. However, the present day high school if it is to keep pace with the progress of the best educational thought must offer courses that will better fit the needs of the pupils who end their school career sometime during its four years.

The demands of the colleges for certain kinds of preparation have not only dominated the curricula of many schools, but have also shaped many of the courses offered in practically all of our high schools. It is probable that no line of work has suffered more than the courses in high school science. Usually the men who examine the work for the College Entrance Boards are specialists in the various so-called special sciences. Their aims in teaching are to prepare specialists and so they are looking for preparation which tends almost entirely to specialization. In the past, even the preparation of the science text books has been left almost entirely to the representatives from our college faculties. It has made it possible for them to dominate the entire field of high school science. This may possibly be well for the few who plan to go to college, but how about the 95 percent who do not? Then again in regard to the boy or girl who does plan to go to college, should their preparation be filled with formulae and laws foreign to their interests, laboratory exercises that have no connection to life or should their preparation be composed of a rich experience that will make a natural setting for the specialization that is to follow? A study of the biographies of our famous scientists seems to show that they had a rich scientific experience from which to draw.

We must all agree that it is a great disadvantage for the boy who does not plan to go to college when he is compelled to remain in the college preparatory science classes of the present day. What all young people need is an opportunity to observe and to receive the training which will help them to solve their problems by the proper application of their past experiences. While we are looking ahead at the college course we must not forget that we have a duty to perform for the "Ninety and Nine." They must be trained so that they will have received the best training possible for life at any time when they may become lost to us.

The material incorporated in most texts as well as the general plan of the courses are such as to divorce the pupil from anything that is familiar to him so the teacher must build around the boy or girl a new environment that is entirely foreign to their past lives. The present day tendency is to break away from a part of this old line work and to teach according to the pupil's interests. This then is the strong argument for the method and

subject matter found in the present courses offered in general science.

While the past few years have witnessed such a phenomenal growth in the registration of the high school, statistics seem to show that at least 70 percent have left us by the end of their second year. It is probable that statistics covering the war period would show a far greater loss. Without a doubt a large amount of this exodus from the high school before the completion of the four years is due to the fact that we are not giving the pupils the training that appeals to their interests. Then too, many of our pupils become discouraged because their programs are too heavy during the early years of the course. The cry has been to give them a little of this and a little of that before they leave that when they go they will be the better prepared for life. How many leave because they are stuffed beyond endurance when they should be allowed to take less and digest more? They come to us as hot-house plants under the supervision of a single grade teacher. They have been watched and encouraged at every turn. They enter the modern high school where they are under the instruction of several teachers and left to shift for themselves. The crowded program and the freedom has been too much.

The greatest opportunity offered us to build a strong future citizenship is to hold our pupils in school until they are better prepared. The only successful way to accomplish this is to work on their interests. Interest will develop quickly into habit and when habit for study and observation has once been formed the greatest obstacle to our success has been removed.

In nature the greatest accomplishment for the adolescent is experience getting. Why should we not start the early science work of our pupils along the line of his natural questions? The only way of making his science vital to him is to teach him to read from it the answers to his questions. Nature will answer them if he asks her in the proper way. Most, if not all of us, can prove this from our own experience.

Someone may say that this is undoubtedly true for the mature student but how about the boys and girls as they enter high school? The little babe in a few weeks is a bundle of habits while while few habits are formed after the middle life. We must admit that science depends largely on certain habits of thought,

observation and conclusion. The earlier in life our pupils start, providing the start is made by a natural avenue, the better. Even the nature study during early childhood produces certain results that appear all through life. Science demands observation. It comes to some much easier than to others but to all it is something closely akin to habit and as such must be started early in life. The child is all observation. Many times it is not the kind we desire, but he is full of questions and these questions are prompted largely by observation. This trait of childhood trained becomes the habit we admire in the true scientist.

Science demands much so-called reflective thinking and experience tells us that concentration is the first requirement. One great criticism of the training of the present day pupil is his lack of ability along this line. It cannot be secured without much training and this comes best to the younger pupils, while the mind is in a more plastic stage.

Begin science during the early adolescent years when this kind of training can best be attained. The mind is then ready to begin careful thinking. The great factor that should enter here to determine what material should be taught will be that which connects most closely with his environment and experience. When his work in this type of science begins, his experience will broaden along the lines of guidance. In order that the pupil may get this experience to the best advantage, the work must be to his liking and should be spread over considerable period of time. Many of our best school systems have acknowledged that a long exposure in certain lines of work even if no more hours are given to instruction, are to be preferred. To meet this conclusion, they have organized what is known as the Junior High School. Where tried, this has proved of great value in science work and there is no reason to doubt that the same thing would be true of other lines of study. Where the longer time is allowed for the same amount of work the pupil has more opportunity to deveope while under the influence of the subject matter and the enthusiasm of the teacher.

No boy or girl reaches the age of the first year in high school without doing much thinking and drawing many conclusions, wrong perhaps, but in their crude way scientific conclusions along the lines of their everyday experience. What then is more logical than to teach science, if it is to be taught at all which will

correlate with this experience. Such is the claim by those who are in sympathy with the teaching of general science. While there is much discussion as to what should be included in such a course, the question might well be asked whether that is so important as long as the work covered is drawn from the pupil's experience and is presented in such a way as to encourage investigation on the part of the people concerned. When it comes to the greatest problem connected with the teaching of this type of science, there is no question but that it is the teacher. All of our science teachers are specialists along some line of science and when they take a survey of the course from their pedestal of learning they see a distorted figure. Many teachers with this kind of training have struggled bravely and have overcome to a large extent at least their biased interests.

There are many opponents to this co-called general science and they are not without good reasons. According to Professor Coulter[1], "we are accomplishing much progress in the special sciences as they are now taught and to stop this kind of instruction and give a course in general science would be a backward step in science teaching. On the other hand Professor Barber[2] quotes from others who say that our past science teaching has been nearly, if not quite a failure and to change from a course where we have begun to show some progress would be to court disaster.

It is true that the science work in our schools has been showing vast improvement in the past few years. The attitude of most colleges toward the science offered for entrance will serve to support this claim. On the other hand, will it court disaster to change to general science provided we teach the course by the approved methods? Is it courting failure to stop teaching specialized science long enough to catch the boys' interest in things around him at a time in his life when his faculties of observation are as keen and his likes and dislikes as strong as they are in the 12 to 15 year stage in his development and to connect his school work with his everyday experience. This will teach him to observe and to so fill his mind with his experiences that he can better apply himself when he takes up the special sciences that follow. Many a football play has been planned out in the class while the teacher was explaining some book topic foreign to the boy's interest. Would it have been a loss of time to have ap-

1 "The Mission of Science in Education," School Review, '15 pp 1-9.
2 General Science Quarterly, January 1917.

plied some of the science at hand to the object of his interest and then to have watched him work out the theories in the next practice?

The faults with the course in general science are not with the sciences but with the methods used. Many high school principals are not interested in it. In many cases they have made it a dumping ground for the poorer class of pupils. The classes have often been made so large that no real science work could be accomplished. The principals who feel this way are usually not science men and so are unable to judge as to the proper conditions under which the work should be taught.

New York State Education Department does not credit general science as a science. They have a course in elementary biology which they consider as superior. In many schools the laboratory work consists of drawings and diagrams copied from the text or blackboard. The course in these schools has become one of lectures and demonstrations. There are many schools where it is well taught but this is mentioned to show that it is no more uniform than other courses that might be offered during the first year.

There is one thing certain, if we are to be successful in any line of science teaching we must train the pupil to read his science into his daily life. Whatever label we may give the course the results cannot be other than constructive.

As has been stated by many writers, the great aim of education is to prepare the pupil for complete living. This great aim may be sudbdivided but when we come to the final summary the various plans we have when taken together should prepare the pupil to live in the environment in which he will be placed and enable him to contribute something to the social group. The real aims then do not differ although the methods change much from generation to generation, or even from year to year. We are always teaching from the experiences of past generations. We then must be profiting by the mistakes of those who have gone before. If we are to prepare for service we should attempt to improve our science by making it more appealing to the average pupil. This does not mean that we must place a money value on such work for we are thinking entirely too much of making a living and too little of making a life. Well stated problems thought through to a logical conclusion furnish the best possible preparation for life. Science properly presented becomes an

excellent means to such an end. General science will be the forerunner and will give the pupil a taste of an entirely new line of thought, for up to the first year of the high school he has had little opportunity to study along his own observations.

It seems that there are three distinct results to be accomplished by general science which have not been accomplished under the old lines of science teaching. They are about as follows: to enable the pupil to choose more wisely in his later studies, to help him to understand in a practical way the common experiences of his everyday life as well as the natural laws controlling them and to prepare him to better enjoy nature throughout his life. It will be seen that each of these results if attained will lead the pupils to become thinkers and thus make them of more service to the community and give them greater enjoyment in life.

The high pressure of living in this age is so great that the pupil can ill afford to lose any valuable time during his years of preparation. He must plan for his life work before he has had sufficient opportunities to know his own abilities. A little taste of the general field of science may give him a new view and enable him to make choices which will lead him along entirely different and more useful lines of service. Any one of the special sciences will not give the same broad outlook in the scientific field.

Again, the pupil to be of the greatest service to mankind must understand the workings of the scientific laws as they are applied to machinery and other conveniences of our modern life. The boy or girl who knows nothing of the applications of electricity, or who does not understand the operation of our water and sewer systems or who does not practice the laws of hygiene will be laboring under a hopeless handicap.

One of the greatest assets to modern efficiency is to be able to forget the trials of life and enter into enjoyment which will afford complete relaxation. If the person can have some line of enjoyment which will give an opportunity for high and noble thoughts so much the better. The commercial pleasures of the modern city are always degrading and cause the sapping of vitality if followed to any great extent. Nature on the hand will lead to health and strength building processes wherever she is

given a fair trial. There is little probability of the young person who follows some line of nature as a hobby, going wrong. God speaks through nature and her language is always pure and ennobling.

All of this fits into the scheme of education as we know it today. We are fast getting away from the idea that we must cram subject matter at the expense of the broad view which our high school subjects open up to us and our pupils. Thought training is the main part of our education. The man who can think logically is the man of whom we speak as educated whether his preparation came through high school and college experience or whether the experience was that of hard knocks.

No science in the high school comes so close to life and its everyday happenings as general science. This is especially true when it is presented by the live teacher through a series of problems know as projects.

Standardization of "First Year Science Tests"

P. A. MAXWELL, High School, Edgewood, Pa.

The following is a resume of the work done in preparing a series of standard tests in general science. As set forth in an article in the General Science Quarterly, May 1920, the preliminary work was as follows:

First, 65 questions to test range of information, and 20 problems to test reasoning ability were prepared. On the basis of the work of two hundred ten high school pupils who had had one year of general science, the questions and the problems were then revised and an approximate value for each was determined. The values depended upon relative difficulty, more credit being given for a hard question than for an easy one. Finally they were printed in the form of an "Information Test" and a "Reasoning Test," and the work of standardization was begun.

The tests were given in June 1920 to 665 pupils in the following schools: William Penn High School, Philadelphia, Pa.; Schenley High School, Pittsburgh, Pa.; Salem, Mass., High School; Peabody High School, Pittsburgh, Pa.; Avalon,

Pa.; High School; and Sewickley, Pa., High School. From the per cent failing each question or problem, a percentile score was then determined according to the following table:*

* The percentile scores were determined from the work of 503 pupils by use of table V, appendix, H. O. Rugg's "Statistical Methods Applied to Education."

INFORMATION TEST

Ques. No.	Times Answered	Per cent Failing	Percentile Score	Ques. No.	Times Answered	Per cent Failing	Percentile Score
1.	269	46.7	49	34.	383	23.9	36
2.	234	53.5	51	35.	73	85.5	71
3.	346	31.2	41	36.	26	94.8	81
4.	274	45.5	48	37.	77	84.7	70
5.	287	42.9	47	38.	91	81.9	68
6.	327	35.0	43	39.	158	68.6	59
7.	236	53.1	52	40.	106	78.9	66
8.	125	75.2	63	41.	200	60.2	55
9.	340	32.4	41	42.	110	78.1	65
10.	62	87.7	73	43.	127	74.8	63
11.	83	83.5	69	44.	168	66.6	58
12.	107	78.7	65	45.	141	72.0	61
13.	96	80.9	67	46.	242	51.9	51
14.	263	47.7	49	47.	240	52.3	51
15.	269	46.5	49	48.	93	81.5	67
16.	242	51.9	51	49.	149	70.4	60
17.	132	73.8	62	50.	230	54.3	52
18.	4	99.1	93	51.	82	83.7	69
19.	281	44.1	47	52.	76	84.9	70
20.	237	52.9	51	53.	86	82.9	69
21.	27	94.6	81	54.	73	85.5	71
22.	398	20.9	34	55.	327	35.0	43
23.	301	40.2	45	56.	332	34.0	42
24.	402	20.1	34	57.	156	68.9	60
25.	56	88.9	74	58.	88	82.5	68
26.	133	73.6	62	59.	92	81.7	68
27.	133	73.6	62	60.	127	74.8	63
28.	222	55.9	53	61.	241	52.1	51
29.	155	69.2	60	62.	123	75.5	63
30.	53	89.5	74	63.	386	23.3	36
31.	191	62.0	56	64.	82	83.7	69
32.	355	29.4	40	65.	261	48.1	49
33.	126	75.0	63				

REASONING TEST

Ques. No.	Times Answered	Per cent Failing	Percentile Score	Ques. No.	Times Answered	Per cent Failing	Percentile Score
1.	264	44.4	47	11.	46	90.3	75
2.	336	29.3	39	12.	294	38.1	44
3.	354	25.5	37	13.	219	53.9	52
4.	235	50.5	50	14.	77	83.8	69
5.	104	78.1	65	15.	305	35.8	43
6.	278	41.5	46	16.	240	49.5	50
7.	122	74.3	63	17.	240	49.5	50
8.	163	65.7	58	18.	63	86.7	72
9.	70	85.3	70	19.	45	90.5	75
10.	315	33.7	42	20.	206	56.6	53

During the work of standardization five questions and four problems proved undesirable and were dropped. Those remaining were arranged in two series, each series comprising an information test of 30 questions and a reasoning test of 10 problems. They were made as nearly alike as possible in scope and difficulty. Series "A" appears on page 229

In the grading of the tests, the scores for questions not answered correctly are struck out. The sum of the others is the score for the test. The Information and Reasoning Tests are graded separately. All answers are either entirely right or entirely wrong. The acceptable answers accompany the printed forms.

The standard scores for the tests were determined in the following manner: The score for each question was multiplied by the number of times it had been answered correctly by the 665 pupils. The products so found were added together for each test, and the sums were divided by 665, giving the following average scores or standards:

	Information	Reasoning
Series A	656	177
Series B	662	179

Following is the table of data from which the standards for Series A were determined:

INFORMATION TEST

Ques. No.	Percentile Score	Times Answered	Product	Ques. No.	Percentile Score	Times Answered	Product
1.	60	247	14820	17.	63	227	14301
2.	34	534	18156	18.	43	435	18705
3.	58	246	14268	19.	51	362	18462
4.	81	62	5022	20.	69	142	9798
5.	61	237	14457	21.	63	229	14427
6.	36	515	18540	22.	45	419	18855
7.	56	254	14224	23.	51	347	17697
8.	74	93	6882	24.	69	161	11109
9.	62	184	11408	25.	65	210	13650
10.	40	496	19840	26.	47	435	20445
11.	53	300	15900	27.	68	185	12580
12.	71	147	10437	28.	66	166	10956
13.	63	168	10584	29.	49	395	19355
14.	42	486	20412	30.	67	170	11390
15.	52	374	19448				
16.	70	142	9940				436068

REASONING TEST

Ques. No.	Percentile Score	Times Answered	Product	Ques. No.	Percentile Score	Times Answered	Product
1.	50	321	16050	6.	42	435	18270
2.	39	456	17784	7.	65	152	9880
3.	50	338	16900	8.	63	190	11970
4.	72	87	6264				
5.	47	336	15792				112910

The printed forms together with the answers and instructions for giving the tests can be obtained from the author.

SERIES A

INFORMATION TEST

Directions

The following questions are to be answered by a single word (in a few cases two words) or by a number. Examples:

1. What is the lightest element?____________________.
2. What is the speed of light in miles per second?__________.

The word "hydrogen" should be written in the space following the first question. The number "186,000" should be written in the space following the second question.

Questions

Score		
60	1.	What substance present in the air determines humidity?____________________.
34	2.	What fiber makes the best clothing for cold climates?____________________.
58	3.	What is the source of all energy upon the earth?______
81	4.	What is the raw material necessary for fermentation?____________________.
61	5.	How many electrodes are there in an electric cell?____
36	6.	What element is taken from the air by a burning substance?____________________.
56	7.	What is the structure found at the top of a pistil?_____
74	8.	In shoveling coal what principle is illustrated when the coal leaves the shovel?____________________.
62	9.	How many pounds does a cubic foot of water weigh?___
40	10.	Against what disease is vaccination a preventative measure?____________________.
53	11.	To what microorganism is decay due?_______________
71	12.	What is the line on a weather map that joins points of equal temperature?____________________.
63	13.	How much heat is required to raise the temperature of one gram of water one degree, Centigrade?________
42	14.	From what mineral is coke made?_________________
52	15.	What are substances that do not conduct electricity called?____________________.
70	16.	What is the rotating coil of a motor called?_________
63	17.	In what organ of a plant is starch made?____________
43	18.	What class of substances turns blue litmus red?_______
51	19.	For what is Marconi famous?____________________.
69	20.	What kind of energy does an electric motor produce?____________________.

63 21. What form of energy is readily changed into magnetism?______________________.
45 22. What substance is produced by the stamens of a flower?______________________.
51 23. What do carbohydrates produce for the body?________
69 24. What force causes water to rise through the soil?_____
65 25. What is the unit structure of which all living things are composed?______________________.
47 26. Of what raw material are bricks usually made?_______
68 27. To what class of simple machines does a pair of scissors belong?______________________.
66 28. Who discovered the antitoxin for hydrophobia?_______
49 29. What is the best method for purifying water?_________
67 30. What part of the human eye functions like the plate or film of a camera?______________________.

REASONING TEST

Directions

This is a test of your ability to think and reason scientifically. You are given certain information and then asked a question about it. You may answer either "yes" or "no"; or if you do not think a conclusion can be drawn, answer "I cannot answer." Base your conclusion upon the information given in the problem, not upon your own beliefs. Indicate your answer by a check as in the following example to which "yes" is the correct answer.

Example. An oxide is a compound consisting of oxygen and some other element. When the element hydrogen burns it unites with oxygen to form water. Is water an oxide?

Yes ✓ No I cannot answer

Problems

Score

50 1. An element is a substance that cannot be decomposed or broken up into other substances, nor can it be made by the union of other substances. I added a piece of the element zinc to a liquid. The element hydrogen came from the mixture. Did the liquid contain hydrogen?

Yes No I cannot answer

39 2. Water rises to the surface through tightly packed soil better than through loose soil. In dry climates farmers desire to prevent the water from rising to the surface where it evaporates. Should they keep the surface loose?

Yes No I cannot answer

50 3. For ten years a certain baseball club has not won a game played on "Friday, the thirteenth." Should that club refuse to schedule games for Fridays that come on the thirteenth?

Yes No I cannot answer

72 4. There were two farmers. One always planted his cucumber seed in the light of the moon. His vines produced many blossoms, but little fruit. The other planted his seed

in the dark of the moon and reaped fine crops of cucumbers. Is it better to plant cucumber seed in the dark of the moon?

Yes No I cannot answer

47 5. Matter is the only thing in the universe that possesses weight. I heated a vessel containing copper to a high temperature. Before heating it weighed 21 grams. After heating it weighed 22 grams. Was any matter added to the vessel when heated?

Yes No I cannot answer

42 6. A solution of a base becomes red when phenolphthalein is added to it. No other solutions are affected in this way. When phenolphthalein is added to a solution of sodium carbonate the solution turns red. Is there a base present?

Yes No I cannot answer

65 7. George Washington, Abraham Lincoln, Ulysses S. Grant, Theodore Roosevelt, and many other great men were raised in the country. Are people raised in the country apt to be more successful than people raised in the city?

Yes No I cannot answer

63 8. When two bottles are filled with any two gases, one gas in each bottle, and held mouth to mouth one above the other, the gases will soon mix thoroughly, half of each being found in each bottle. Is the air near the ceiling of a room as pure for breathing as the air near the floor?

Yes No I cannot answer

John F. Woodhull Retires

After forty-one years of service in the profession of teaching Professor John Francis Woodhull of Teachers College retires. How great has been his influence upon science teaching none can tell but all who have come intimately in contact with him have felt the power and influence of his ideas and probably no other single force has had so great an influence in shaping the changes which science teaching has undergone in recent years. We regret to lose such an active leader from the profession but rejoice that he can have a well earned leisure. Even at the risk of making the reader envious we quote from a recent letter which suggests some of the joys to be experienced. "Mrs. Woodhull and I plan to take our tent and cooking utensils and live a gypsy life on the road. We have a Ford touring car for that purpose and shall do the United States, migrating north and south with the birds and living chiefly in Uncle Sam's parks."

"People of mature age become used to their own surroundings and pay but little attention to fire prevention, which makes it necessary and important that fire prevention be taught in all schools for the purpose of impressing upon the minds of youth lessons that will last throughout their lives."

HON. J. A. TRACEY, Des Moines, Iowa,
President, Fire Marshals Association of
North America.

Five Years of Fire Waste

From compilations made by the National Board of Fire Underwriters, it is learned that the aggregate fire loss in the United States covering the years 1915-1919 was nearly one and a half billion dollars. This loss to the country is, perhaps, better appreciated by considering what such an amount of money would do if *used* instead *wasted.* The five loss equals the cost of building four Panama Canals; it would build 300,000 new houses at a cost of $5000 each, more than enough houses to supply the population of the entire state of Connecticut; or it would build 150,000 miles of macadam road at $10,000 per mile. The equivalent of a macadam road six times around the earth at the equator is thus destroyed in the United States in a five year period. An account of some of the causes of fires, reprinted with permission, from *Safeguarding America Against Fire,* follows:

Defective Chimneys and Flues: In the five years this strictly preventable cause was responsible for the fourth largest loss, amounting to $56,650,915, or an average of $11,330,183 annually. This heavy property destruction furnishes a striking commentary upon our generally haphazard methods of constructing chimneys and flues. Among the states, New York suffered most from this cause, its loss reaching $5,142,101.

An Example of Rural Chimney Construction that Needs no Comment.

Photo by courtesy R. A. Foose
The Result of Looking for a Gas Leak with a Torch.

Gas, Natural and Artificial: During the five years losses from this cause aggregated $10,203,330, or an average of $2,040,666. New York led the list with property destruction of $1,612,371, while Pennslyvania came next with $1,238,567 and Ohio third with $1,012,944. Such highly inflammable elements as natural and artificial gas need to be protected by every possible safeguard. Many fires are caused by searching for leaks with flaming lights or by other means of ignition. Sometimes a short circuit in a combination electric and gas fixture will cause a fire.

Hot Ashes and Coals, Open Fires: Supposedly defunct ashes and coals placed against wooden partitions, in wooden barrels or otherwise carelessly disposed of, are fairly certain to cause trouble. Grouped with open fires, these hazards were responsible for losses in the five years of $11,806,754, thus averaging $2,361,350 per annum. Once more New York is

found to have paid the heaviest toll, aggregating in this instance \$1,014,182. Pennsylvania was next with \$721,598.

Ignition of Hot Grease, Oil, Tar, Wax, Asphalt, etc.: This hazard, which as far as grease is concerned has caused many fires in hotel and home kitchens, showed an aggregate loss for the five years of \$4,490,269, or \$898,053 a year. The heaviest damage under this heading, \$936,742, occurred in Pennsylvania, New York being number two with \$651,884. South Carolina is found at the bottom of the list with \$1,106, and Arizona showed the next lowest total, \$1,749.

Photo by courtesy Jay W. Stevens
Hot Ashes and a Wooden Barrel Make a Dangerous Combination.

Burning Grease Starts Many Fires.

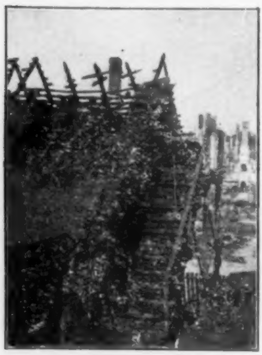
Open Lights: Candles or other open flame lights for illuminating purposes in closets or dark corners filled with inflammable rubbish are prolific causes of fire. The total damage from this hazard, during the five years under discussion, amounted to \$13,956,032, which represented an average of \$2,791,206. Michigan stands out as the chief sufferer from this cause, with losses of \$2,480,819, the figure exceeding New York's showing by a little over \$42,000. Nevada's total was only \$2,540.

Rubbish and Litter: It is probable that the hazard created by poor housekeeping in home and factory has been tempered by the widespread clean-up campaigns of recent years, for the total losses shown, of \$3,511,824, compared favorably with those due to other causes. Illinois disclosed the heaviest damage, \$501,018; Massachusetts stood second with \$253,507,

Photo by courtesy N. L. Fire Dept.
Beware of Gas Brackets Near Window Curtains.

Inflammable Rubbish in Basements is a Menace to Life.

and Pennsylvania third with $240,117. New York's losses in this column were but $146,997. Wyoming displayed the lowest total, $524, and Nevada the next smallest, or $935.



What Sparks Will Do to Inflammable Roofs.

Photo by courtesy Nat. Automatic Sprinkler Assn.
Where 173 School Children Were Burned to Death in a Fire Caused by an Overheated Steam Main.

Sparks on Roofs: In many of our states, particularly those in the South and Middle West, owing to a mistaken idea of economy, a majority of the buildings have been covered with wooden shingle roofs, which in the course of time become tinderlike and easily ignited. Alabama suffered larger losses

from this cause than from any other. The result is seen in the five-year aggregate of $29,271,585, or at the rate of $5,854,317 yearly. The largest toll of all the states, $2,842,985, was paid by Illinois and the next heaviest, $2,070,399, by Michigan. Indiana's total of $1,942,736 was the third largest.

Steam and Hot Water Pipes: To many persons, the chances of steam or hot water pipes causing fire seem remote, but in order to realize the serious possibilities of this hazard it is necessary only to recall the Collinwood School holocaust, in which 173 children lost their lives. The fire was started by an unprotected steam main passing through the floor of the first story. During the five years the property damage in this column amounted to $1,851,434, with New York's total of $420,566 the heaviest in the list.

Where a Defective Boiler Caused Heavy Loss.

Photo by courtesy J. W. Stevens

An Electric Warming Pad That Produced Too Much Heat.

Stoves, Furnaces, Boilers and Their Pipes: The fifth place among serious fire hazards is occupied by stoves, furnaces and their appurtenances, which, as the result of overheating or structural defects, caused property destruction aggregating $55,133,181 during the five years from 1915 to 1919, inclusive. The heaviest loss from this hazard, $6,363,387, occurred in New York, while Illinois occupied second place with an aggregate of $4,937,864. Pennsylvania stood next with $3,738,726, and Michigan fourth with $3,408,753.

Electricity: When Benjamin Franklin made his famous kite experiment, he little thought that electricity would one

day become the chief fire hazard of the Nation, albeit he was given to moralizing upon the subject of fire prevention. There is a greater loss of property due to electrical fires today, however, than to any other known cause, the five-year total amounting to $84,086,471, or an average of $16,817,294. New York suffered the heaviest loss, although the state's total of $7,977,408 was not far above the $7,785,663 of Pennsylvania. Illinois showed the third largest figure, $6,538,766, and California the fourth, $5,060,683.

Exposure (Including Conflagration): When a fire communicates from the building in which it originates to another structure, the second fire is classified as having been due to exposure. The total damage under this heading of $202,176,433, or $40,435,286 on the average, far exceeds that from any of the other losses from known causes. Among the individual states, New Jersey, with a total of $24,255,540, suffered the heaviest damage in this column, New York standing in the second place with $23,454,569.

Artificial Lighting as Compared with Natural Lighting

J. H. KURLANDER, Harrison Office, Edison Lamp Works.

As standards of illumination advance with the times, the question naturally arises in the minds of all those vitally concerned with lighting matters as to the limits to which artificial illumination can be raised without proving harmful or annoying to persons in the immediate vicinity.

When speaking of lighting matters, the term "foot-candle" immediately comes to mind as the fundamental unit of measurement. To the layman this unit is invariably a means of comparison. One may not know what a foot-candle is, and yet be able to sense the difference in intensity on two separate work places. Thus we may hear one advance this complaint, "Smith has twice the amount of light on his desk that I have on mine."

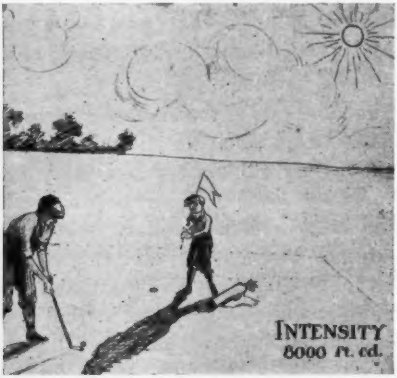
The number of foot-candles involved in this case would, perhaps, never be given a thought; thus we go through every walk in life comparing this with that in order to form some basis of judgment. Questions come up as to the proper working intensi-

ties in the various branches of industries, and as we see these standards ever rising, questions similar to, "Where is the limit to all this? How high can we really go?" form themselves in the minds of interested persons. Today four foot-candles may be considered good practice for a certain class of work, and a year hence fifteen foot-candles may seem inadequate for the same operation. When we poor mortals come up against a particularly puzzling problem, we usually turn to nature in an effort to effect a solution. Thus, when seeking an answer to the limit to which we may go in lighting, our good friend, the sun, offers a solution.

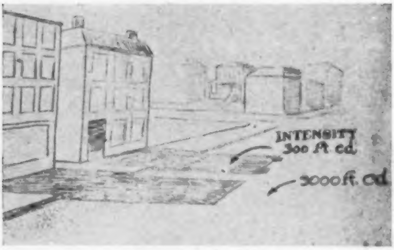
Simple photometric measurements taken in daylight under different conditions prove conclusively that the human eye can adjust itself to intensities far higher than those we ordinarily associate with artificial lighting.

In order to gain some idea as to the daylight intensities present upon various surfaces, men from the Lighting Service Department took some readings with a portable photometer. The results are shown in the table given below.

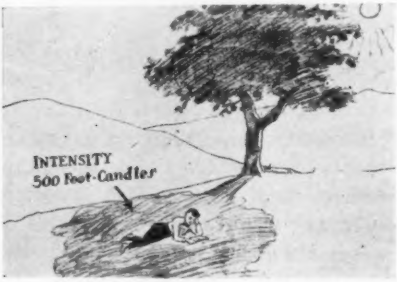
The readings were taken at mid-day when the sun was shining brightly. Crayon drawings were then made depicting in a graphic manner the conditions under which the readings were taken. These figures shown in the accompanying illustrations were used in the Sales Courses for illustrating various daylight intensities.



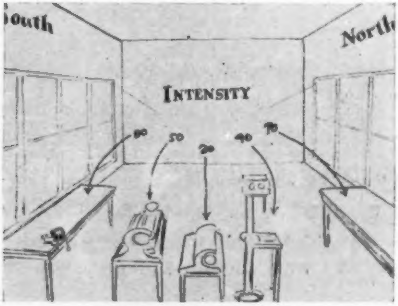
Sunlight on open field .... 8000 foot-candles



Sunlight in middle of street between buildings .... 3000 foot-candles
In shade of building .... 300 "

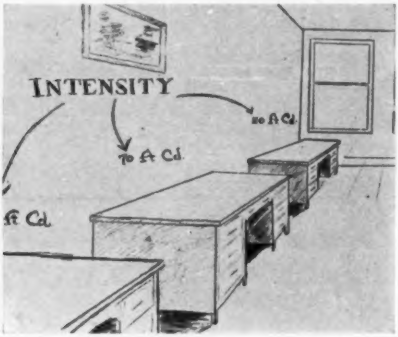


In shade of tree .... 500 foot-candles



INDUSTRIAL PLANT

On bench next to window, southern exposure .... 90 foot-candles
On bench next to window, northern exposure .... 70 "



OFFICE

Desk next to window, southern exposure	110	foot-candles
Desk 10 ft. from window	70	"
Desk 18 ft. from window	50	"

It must be remembered that these figures are only approximate ones, because daylight varies over wide ranges during short periods of time. Few people with normal eyes will ever complain of too much light during the daytime unless glaring conditions are present. We see from this, then, that the eye can readily accommodate itself to very high intensities, far higher than those used in any industrial plants. This does not mean, however, that we should go about advocating increases in intensities equivalent to those experienced in daytime, but it does prove one thing in a forcible manner: there is practically no such thing as *over* lighting, and investigations of places which are said to be overlighted will usually show that if anything they are *glaringly underlighted.*

Dental Service for Rural Schools

W. A. BRIERLEY, D.D.S., Denver, Colorado.

While "the little school house on the hill" does well as a figure in rural scenery, and has long held its place as a thing to think back to, as in memory we live over again the days of our childhood, when measured by modern standards, we know it is not now and never was worth much as a place in which to get an education.

This article is not written in a spirit of criticism, but with the kindliest of feelings for and the hope of contributing something

to the betterment of a class of schools which in the aggregate comprise probably our largest single educational factor—the American rural schools.

Fig. 1. A lesson for the Eighth Grade.

Fig. 2. An important feature of the work.

There are 21,000,000 children in the public schools of this country; 9,000,000 are in city schools, and 12,000,000 are in ru-

ral schools. One-half of the latter figure (6,000,000) are in the one and two-room schools of which "the little school house on the hill" is a type.

Most states have many hundreds of school districts, each with a separate school board. One western state with which the writer is familiar has 1,900 school districts. Only thirty of these are in Class I, which are districts having a school population of over 1,000. Sixty-eight are in Class II, with a school population numbering between 350 and 1,000. Class III districts comprise all having less than 350 school population. About the same conditions will be found in other states. In the state referred to there are 135 "centralized" or "consolidated" schools, which are made up by combining schools of the second and third classes.

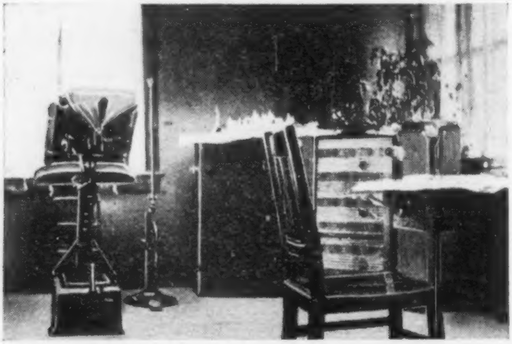


Fig. 3. Equipment ready for use.

Fortunately more than one-third of the second and third class schools have been "standardized," which means they have been judged by committees that pass upon the qualifications of teachers, courses of study and how presented, condition of grounds and buildings, with reference to location, sanitation, heating, cleanliness, etc. While the schools which are not standard are probably doing the best that can be done, considering some of the adverse conditions under which they have to operate, many of them are "playing a lone hand" in matters pertaining to efficiency, meeting little in the way of requirements outside of those imposed by their own school boards. The sad fact about the schools which have not been

standardized is that they are so numerous, comprising as they do more than half of all the districts in the state, with about one-fifth of all school children in the state as their pupils.

For reasons which are plain to everybody, as places of learning, the city schools are generally considered superior to rural schools.

Fig. 4. Transportation

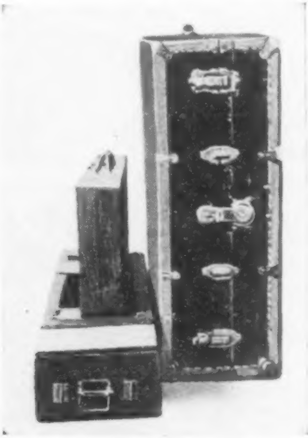


Fig. 5. Ready for shipment.

Under the supervision of the Bureau of Education in Washington, twelve "Regional Conferences of Citizens" have recently been held to urge the necessity for raising more money to promote the interests of the public schools. In this proposed program all health measures will receive increased consideration.

Dentists are more or less familiar with reports of the deplorable dental conditions found among public school children. Most of such reports have come from examinations made in city schools. The writer believes that dental conditions are even worse in the country schools, and is convinced that the advent of the dentist and dental hygienists in rural schools would indeed be a god send to numberless suffering children, and as an influence contributing to the uplift of those schools would be quite the equal of anything which could be done for them.

Providing dentistry for rural schools is not a difficult task. Suitable portable equipments can readily be adapted to meet every requirement.

The equipment herein described was in use for three years for a group of twenty-four rural schools located in Colorado and Wyoming having an aggregate enrollment of over 5,000. To reach all of these schools it was necessary to move the equipment eighteen times.

Fig. 6. Crested Butte, near Gunnison, Colorado.

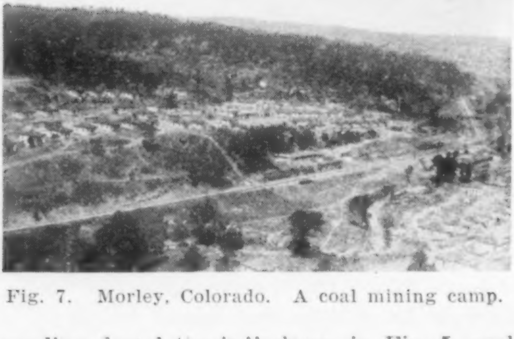


Fig. 7. Morley, Colorado. A coal mining camp.

The traveling dental "unit," shown in Fig. 5, packed and ready for shipment, consists of a portable operating chair, a foot engine and a wardrobe trunk. The trunk makes a very good dental cabinet when stood on end, besides providing a means for carrying all operating instruments, filling materials and supplies. The advantage of using wardrobe trunks is that they are built to stand shipping, and in case of accident new ones can be secured at any trunk store.

The engine case when opened out flat and placed on top of the partially-open trunk forms a good operating table. Upon this table towels are placed, and the instruments and materials which are more often used can be conveniently arranged. All other equipment can be kept in the drawers and trunk compartments.

The hangers in the trunk are used for the operator's coats and the assistant's uniforms.

The "unit" weighed 400 pounds, and was usually shipped by express, although often it was transported via the faithful flivver as shown in Fig. 4.

Fig. 3 shows the equipment set up in a residence located conveniently near the school.

Sometimes it was necessary to carry an extra trunk for supplies in case of long trips being made from the supply base. Dental literature, charts and lantern slides for public lectures were also a part of the equipment.

Conducting tooth brush drills was a part of the routine work and talks from charts to classes of the higher grades were given when possible. This latter was considered important as a means of getting the lessons in mouth hygiene carried directly to the homes.

Figs. 6 and 7 show the class of towns visited.

February, 1921, *Oral Hygiene.*

The Nostrum and The Public Health*

ARTHUR J. CRAMP, M.D., Director of Propaganda for Reform Department, The Journal of the American Medical Association.

Broadly speaking, the nostrum belongs in one of two general classes; one class comprises those unscientific mixtures that are advertised primarily to the medical profession, and first reach the public by way of the prescription; the other class includes those mixtures that are sold direct to the public. Nostrums in the first class are sometimes spoken of as "proprietaries"; those in the second class are colloquially known as "patent medicines." The public suffers from both classes, the only difference being that in the case of the former the physician has to share the responsibility with the nostrum exploiter. There is no clear-

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* Read before the Chicago Medical Society, March 26, 1919.

ly defined line of demarkation between these two classes. Many of the "patent medicines" of today were the "proprietaries" of yesterday. Shrewd manufacturers—or, more correctly, exploiters, for many of these products are not manufactured by those that sell them—discovered years ago that one of the least expensive methods of introducing a nostrum to the public was by way of the medical profession. After the profession had been widely circularized and much space bought in the advertising pages of medical journals of a certain type; later uncritical or unthinking physicians had prescribed the products (of course in the "original package" with the name blown in the bottle or a monogram stamped on the tablet); after the patient had learned with disgust that his physician had merely prescribed a "patent medicine" that could more cheaply have been purchased direct—then the one-time "proprietary" threw off its "ethical" mask and became frankly a "patent medicine." Such has been the genesis of many a "patent medicine" on the market today. Others, less deviously, have gone directly to the public at the outset.

FEW IF ANY, REAL PATENT MEDICINES

The present paper deals with the "patent medicine" evil. Correctly speaking, there are practically no true patent medicines on the market; first, because few if any of the products of this type could be patented, and second, because patency or openness is the last thing the average "patent medicine" seller wants. Mystery and secrecy are his great assets. A product to be patentable must, according to the law—not always enforced, by the way—represent something new and useful; and this requirement of the patent law rules out the "patent medicine." A patent when granted gives the owner a legal monopoly on his product for seventeen years, after which time the product becomes public property. The "patent medicine" seller finds it easier and far more profitable to put together a simple mixture of drugs that represents nothing either new or useful, to which he gives a fancy name, and obtains a trade-mark on that name. The trade-mark gives him a perpetual monopoly to the name and places no restrictions on the composition of the product; nor, in the granting, is he required to give any information regarding its composition.

Thus "Winslow's Soothing Syrup" is still "Winslow's Sooth-

ing Syrup" in name, although the product on the market today bears but little resemblance to the original preparation sold under that name. As sold in the United States, it used to contain morphin and alcohol. As sold in Great Britain, potassium bromid was substituted for morphin because the British law requires the word "poison" on all "patent medicines" containing morphin. As the public in our country became aroused to the menace of the "baby killers," many drug stores refused to handle the Winslow preparation. Then the formula was changed, and changed again, so that today it contains neither morphin nor alcohol. But it is still "Winslow's Soothing Syrup."

THE FOOD AND DRUGS ACT

There has been a tendency during the past few years to assume that the federal Food and Drugs Act, commonly known as the Pure Food Law, effectively safeguards the public against the menace of the nostrum. Although this law has been in force for more than twelve years, there is still some misapprehension of its powers and limitations. First it should be realized that the law applies only to products that enter into interstate commerce; that is, those that are made in one state and sold in another. The federal Food and Drugs Act, for instance, exercises no control over the sale of "patent medicines" made in Illinois and sold anywhere within the state of Illinois, no matter how fraudulent the claims may be as to therapeutic effects, composition, or source of origin. The only way such preparations can be reached is under the state law.

It should also be realized that the Food and Drugs Act has no jurisdiction over claims made for foods or drugs except as those claims appear in or on the trade package. When the law was first passed, many "patent medicine" makers assumed that the term "label," as used in the Act, applied solely to the piece of paper pasted on the bottle. On this assumption, they modified the false claims they had been making on the label but continued to falsify in the circulars that were wrapped around the bottles. They soon found to their cost, however, that the courts gave a broader and more logical meaning the word "label," including all of the printed matter in or on the trade package. The Food and Drugs Act exercises no control over statements that are published separate from the trade package—such as in newspapers, hand-bills, etc.

The Pure Food Law, as first enacted, prohibited, within the field it covers, "false or misleading" statements "in any particular." The officials entrusted with the enforcement of the Act assumed that this meant just what it said, and the majority of the "patent medicine" makers followed that assumption. Then the Supreme Court decided (in a divided opinion) that the law as it stood did not apply to statements regarding curative effects, but only to statements relative to composition and origin. This decision, of course, let down the bars immediately to the most obvious frauds. The more unscrupulous "patent medicine" makers care little about restrictions regarding the composition of their nostrums; they are much more concerned with being free under the law to make any assertion they see fit regarding the curative effect of their preparations. Then came the Sherley amendment to the Food and Drug Act, which specifically prohibits "false and fraudulent" statements regarding the curative effects of medicines. It is to be noted that falsehood alone is not sufficient to secure conviction; the manufacturer must also be found guilty of deliberate intent to defraud.

Under the Food and Drug Act, then, the manufacturer of a medicinal product may be declared guilty of misbranding, if the statements he makes (on the trade package) regarding the composition or the origin of his products are either "false or misleading"; he may also be found guilty of misbranding if the statements he makes (also, on the trade package) regarding the curative effects of his preparations are both "false and fraudulent."

Limiting the scope of the application of the law to the claims made on the package, is one of the fundamental weaknesses of the Food and Drugs Act. The law does oot penalize the most outrageously false claims of any kind or description regarding "patent medicines," if those claims appear in newspaper advertisements, circulars, etc., that do not accompany the trade package. Yet it is the newspaper advertisment or the circular that sells the product, rather than the matter on the trade package, which the public does not see until after it has purchased. Thus we have the anomaly of a law which allows a manufacturer to lie to his heart's content in those avenues of publicity in which lying will be most profitable and do the maximum amount of harm and restricts merely the statements he may make in his trade packages. This limitation in the Food and Drugs Act furnishes

a sure way of determining with almost mathematical accuracy what statements regarding a "patent medicine" are false: From the claims made in the newspaper advertisements and circulars subtract those that are made in the trade package; the difference, you are justified in assuming, is falsehood!

LIMITED FORMULA DISCLOSURE

The "Pure Food Law" has one more power in protecting the public against the nostrum evil: It requires "patent medicine" sellers to declare (on the trade package only) the presence and amount of eleven drugs and their derivatives: alcohol, morphin, opium, cocain, heroin, alpha-eucain and beta-eucain, chloroform, cannabis indica, chloral hydrate and acetanilid. Further than this, the law permits the manufacturer to maintain complete secrecy regarding the composition of his preparation. He can, if he wishes, put in his product such deadly poisons as carbolic acid, arsenic, strychnin, prussic acid and aconite, and the public is none the wiser.

Many people have thought that the legend "Guaranteed under the Food and Drugs Act" that used to appear on bottles and cartons indicated that the federal government had in some way passed on the product and given it a clean bill of health. Nothing of the kind. Before the guarantee clause was abolished, any manufacturer could write into Washington and ask for a serial guarantee number, and Washington had no choice but to issue such a number—this, no matter whether the medicinal product was good, bad or indifferent, whether the claims under which it was sold were truthful or false or whether the drugs it contained were harmless or dangerous. All that the guarantee clause ever meant was that were the product sold in violation of the law, the person to whom the guarantee serial number had been issued would be held responsible, rather than the individual retailer. Some of the most outrageous swindles in the "patent medicine" world have been "Guaranteed under the Food and Drugs Act." Summed up, then, it may be said that the federal Food and Drugs Act gives the public a certain measure of protection. It permits the public to know the names and amounts of eleven drugs and their derivatives, and it limits the claims that can be made for these products, so far as such claims appear in or on the trade package.

THE PHYSICSAN'S INTEREST IN THE NOSTRUM EVIL

The nostrum evil is essentially a public health question, although, as in the case of many public health questions, it has its economic angle. The "patent medicine" maker persistently charges that the medical profession's opposition to "patent medicines" as now exploited is based on the assumption that the sale of such products dimishes the income of the physician. The charge, of course, is as malicious as the assumption is false. Next to the "patent medicine" men and the newspapers that share the profits of nostrum exploitation, no class receives greater financial benefit from "patent medicine" advertising than physicians. A hundred people see an advertisement of "Doan's Kidney Pills," with its "Every Picture Tells a Story" illustration conveying the impression that an ache or pain in the lumbar region indicates kidney disease. Out of this hundred, let us suppose one half, because of some passing pain in the lumbar region, are convinced that they have Bright's disease or some kidney ailment. Of the fifty thus frightened into the belief that they are ill, it may be conservatively claimed that considerably more than half will go to their family physician rather than to the drug counter. If all "patent medicine" advertising were abolished tomorrow, next to the exploiters of "patent medicine" and some newspaper proprietors, no one would suffer larger financial loss than the physician. The physician, of course, is opposed to the average "patent medicine" because it is exploited in such a way as to cause the public to magnify its trivial ailments, to drug itself unnecessarily and in cases in which something serious is the matter to lose vitally valuable time in seeking medical aid. Were the physician's attitude toward "patent medicines" prompted by commercial considerations he would say to the nostrum exploiter, "Go the limit; the more victims you get, the more patients I get!"

AN ECONOMIC EXCUSE FOR HOME REMEDIES

Under our present economic system there is a place for home remedies for the self-treatment of simple ailments. It may be that in Utopia the ailing always go to their medical advisers, no matter how trivial the ailment; but this is not Utopia. No one expects every person who suffers from a passing attack of constipation to go to his physician for a prescription. He is going to

the drug store for a cathartic of some kind. Admitting that the abuse of cathartics is one of the most widespread and pernicious of the evils of self-drugging, and admitting, further, that the rational treatment of constipation may not call for any purgative drug, the fact remains that in such cases the man in the street is going to take cathartic drugs, at least until he is better informed. The duty of the medical profession in the premises is to warn the public of the danger of the purgative habit and to urge that some restrictions be thrown around the sale of cathartic medicines. The same applies to the use of other medicinal products that may rightly be classed as home remedies.

Unfortunately, the home remedies of today are, generally speaking, "patent medicines"; and the methods of promoting the sale of "patent medicines" make those products a menace to the public health. This not altogether for what the remedies themselves contain, although in many instances that is distinctly bad, but because of the way such products are exploited. Modern advertising differs from that of the mid-Victorian era in one vital respect. In the earlier days the advertiser notified the public where demands might be supplied. Today the advertiser bends his efforts toward making the public demand things which otherwise it might not want or even know about. This principle may have no serious consequences, other than economic at least, when applied to the ordinary commodities of commerce. There may be more or less plausible arguments in favor of so advertising pianos, automobiles, clothes, or what not, as to persuade the public to purchase more of these articles than it really needs or can afford. There can be no excuse, however, for using such methods in the sale of preparations for medicinal purposes. So to advertise as to make well men think they are sick and sick men are very sick, for the sole and only purpose of causing them to purchase drugs to pour down their throats, is more than an economic offense; it is a crime against the public health. Yet this is the principle on which the average "patent medicine" of today is sold.

SEQUENCE MISTAKEN FOR CAUSE AND EFFECT

There is an additional reason why the present method of exploiting drugs for the self-treatment of disease is vicious. In the sale of merchandise that lends itself peculiarly to fraudulent exploitation. The nonexpert who is led by misrepresentation to

purchase a piano or a suit of clothes which is not up to the specifications learns sooner or later that he has been swindled, and he profits by the lesson. There is no such automatic check operating in the case of medicaments. John Smith gets up some morning feeling sick. It is but a passing indisposition and in a few days he will be himself again, whether he does something or does nothing in the way of treatment. In opening his morning paper, John finds, carefully detailed, just the symptoms that he seems to have, and he is assured that they may be cured by taking "Pink Pills," "Nuxated Iron," "Tanlac," "Peruna" or what not. On his way down town he buys one of these preparations. In a day or two he is well again—as he would have been in any case— and you never can persuade him that his recovery was due to the healing power of nature and not to the preparation that he had been taking. It is equally true, of course, that had he gone to his family physician and received a prescription or had gone to an osteopath and had his back rubbed, or called up a "Christian scientist" and received an absent treatment, he would also have been willing to credit any one of these agencies with his recovery. The point to be emphasized is that it is a very human tendency to credit to artificial agencies all results that are really due to natural causes. The *post hoc, ergo propter hoc* mode of reasoning is well-nigh universal, especially among those with scientific training. Even the medical profession is not altogether free from confusing a mere sequence of events with cause and effect. Here, then, is the reason for urging that in selling medicinal products a different method should be employed from that used in selling ordinary merchandise. The seller or general merchandise has nature as an opponent: wear and tear is constantly against him. The seller of medicaments always has nature as an assistant. The tendency of the human body in sickness is, in the majority of instances at least, to get well; but the healing power of nature seldom receives credit.

THE REMEDY

What then, is the remedy? Obviously there should be home remedies available that are unobjectionable from the public health point of view. Such products should contain no habit-forming or dangerous drugs; they should not be recommended for diseases that are too serious for self-treatment; they should

be non-secret because the public has a right to know what it is taking; finally, they should not be advertised under false claims or in such a way as to make the public magnify trivial ailments and dose itself unnecessarily with drugs. Products which conform to these requirements are to be found on the shelves of every drug store in the country. They comprise certain simple official products from the United States Pharmacopeia or the National Formulary. Naturally, they are non-secret, and being official, their standards of strength and purity are constant and enforced by state and national laws.

As most of the large pharmaceutical houses in the country make them, the element of monopoly is removed, and competition assures their being sold at a reasonable profit. The enormous overhead expense inseparable from the modern method of "patent medicine" exploitation is entirely eliminated. John Smith does not realize that when he pays a dollar for "Dr. Quack's Panacea," at least 75 cents of his dollar represents the cost of the effort on the part of Dr. Quack to convince Smith that there is something seriously wrong with him and that "Quack's Panacea" is the only thing that will cure him. In other words, Smith pays a dollar for 25 cents' worth of drugs and service, plus the privilege of being frightened into the belief that he is seriously sick and that these drugs are essential to his recovery.

Since official drugs, i. e., Pharmacopeial and National Formulary preparations, are nonproprietary, the chief incentive to fraudulent or misleading advertising claims is removed. John Doe & Sons' brand of Blaud's pills, differs in no essential respect from the Blaud's pills of Henry Rowe & Co. The margin of profit on the sale of Blaud's pills is so small that it would hardly be profitable for one manufacturer to attempt any widespread advertising campaign for the special purpose of increasing the sale of his particular brand, even supposing it were possible for him to make claims that could not demonstrably be proved false.

When the public is properly informed, so that it knows what preparations to call for in order to treat its simpler ailments, advertising of home remedies will be entirely unnecessary. It devolves on the medical profession, and other agencies entrusted with the solution of public health problems, to give the public just these facts. In an article published two or three years ago,[1]

1 Wiley, H. W.: The Mother's Medicine Chest, Good Housekeeping, October, 1916.

Dr. Harvey W. Wiley suggested that the American Medical Association should appoint a representative committee to select a few simple home remedies for what he called the "Mother's Medicine Chest," which could be used by the public for the self-treatment of the milder ailments. He urged, further, that somewhat complete directions should be published, describing the nature of the troubles in which these remedies were to be used, and the amount that was to be given under various conditions, in every case, of course, calling attention to the potential dangers inseparable from self-diagnosis and self-treatment. Whether such a task should be undertaken by a scientific organization such as the American Medical Association, or by governmental agencies such as the United States Public Health Service, is a question. There is little doubt, however, that when such information has been widely disseminated, even if it takes a generation to do it, the making of hypochrondriacs by suggestion, and the widespread evil of unnecessary drugging, will be gone. Gone, too, will be the business of those nostrum exploiters who capitalize human fear and fatten on human credulity.

Hygiene Projects for the Upper Grades[1]

By LAWRENCE AUGUSTUS AVERILL
Editor of *The American Journal of School Hygiene*

Beware of the old-fashioned methods of teaching hygiene. They may do very well for teaching Greek, or archæology, or perhaps even agriculture in a girls' seminary, but for virile training of boys and girls in practical and usable health habits and attitudes—never. Such training must be eminently a *participative* process, a *cooperative* process, a *one-hundred-percent-enrollment* process. And how shall we organize the hygiene class in order to give a chance to this participative process? In a certain school which the writer knows the children have been organized into what is called a "Keep-Fit Club." Such other suggested names as "Good Health Club," "Health League," "Sound Body Club," etc., were forthwith dismissed from consideration by the children as not being so challenging, so *pioneering* as "Keep-Fit Club." Possibly the soldier *motif* was at the basis of this feeling on the children's part.

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1 From "The American Journal of School Hygiene," Vol. 4, No. 4.

The club elects one of its numbers president, another vice-president, and a third secretary. In addition to these officials, there is also a committee on meetings to which the teacher, *ex-officio,* belongs, and which with her determines upon interesting projects to be performed by the club. No one—not even the teacher—would think of referring to the weekly club meeting as a *class,* much less a *recitation.* It is rather a *Club* meeting. The president presides, save when the vice-president is able by sound logic to wrest temporarily the chairmanship of the meeting from the hands of the chief executive. Nominally, he is to direct the club in its discussion of the project which chances to be up for consideration. Actually, however, the children need little guidance. Occasionally, it is true, they stray away somewhat from the set topic, but they usually find themselves shortly, and as time goes on they diverge less and less from the aim which they have set up for themselves for the meeting. Interest at the meetings of course runs high. Personal experience is more and more often summoned up as the year progresses, and gradually some of the children even become so bold as to venture to propose and defend opinions of their own which may be quite at variance with those of others—surely an innovation in most throne-rooms. The offices of president and vice-president rotate around the class in the course of the year, so that the best principles of democracy are always in evidence even in the political complexion of the club. The teacher moves dimly across the background of the club setting, but her presence and part are decidedly inconspicuous. Textbooks and hygiene readers are always available and often furnish the entire groundwork for a meeting. Pictures and posters and varieties of other illustrative materials are always to be had in abundance. Initiative, self-control, self-reliance, independence and suspension of judgment, argumentative resourcefulness and other attitudes and attributes of mind are developed, as well as courtesy, broad-mindedness and—above all, perhaps—an intelligent and apparently permanent interest in the general subject of hygiene and health.

Following are some suggested projects in hygiene and sanitation which have and should—attacked in a socialized way—prove interesting and valuable to all upper grade classes. They do not by any means exhaust the list of possibilities, but merely enumerate several lines of investigation that are exceptionally valuable and essentially practicable in the carrying out.

1. **Grading of public markets.** For this project it will only be necessary for the club to determine arbitrarily upon some scheme of grading, and then to assign as many as possible of the local markets to the various teams for studying and ranking upon the basis agreed upon. A scale of 100 is always an excellent working basis, inasmuch as the children are quite familiar with it in connection with their own individual school ranks. 90 or better might be determined upon as representing highest quality of sanitation in each classification; between 75 and 90 might represent varying degrees of fair quality; between 50 and 75 might indicate poor quality; while a score lower than 50 might be understood as representing an unsatisfactory condition of sanitation. The several classifications upon which the markets are to be ranked should include the following: (1) general cleanliness; (2) protection of foods on display; (3) neatness and cleanliness of clerks; (4) condition of screening and absence of flies; (5) care in the handling of unprotected foods; (6) freshness of perishable stuffs; (7) ventilation; (8) refrigeration.

With a team of two or more boys and girls responsible for investigating, scoring and reporting back to the club upon the sanitary appointments and conditions of a specific market, very valuable and significant results should be obtained. Interest in the topic and the desire to make no errors will inspire the children, before finally checking up their results, to make frequent visits to their stores, develop in them keenness in observation, niceness of judgment, and broaden their conceptions of what society has a right to expect and demand of dealers in foods designed for human consumption.

2. **Learning about the local board of health.** The carrying outt of this project, too, may be delegated to several teams. One will find out the names of the persons on the board; how, when, and for how long they are appointed or elected; what their salaries are; and whether or not they are physicians or laymen. Another will concern itself with the financial phase, finding out from available reports how much it costs the city annually to maintain its board of health; what portion of the income from taxation is thus used up, etc., etc. There will be abundant opportunity here for correlation with arithmetic. Still another team will investigate the various duties and activities which the community has a right to expect of its health officials, and in

how far the present board is meeting these expectations. It will be a revelation to most of the children to discover that the work of the health department is classifiable into a considerable number of divisions or bureaus, each one of which nominally at least exercises some measure of control over the general health, comfort and happiness of the community. In addition to all of these lines of attack, a group might very profitably make a survey of the leading health welfare agencies of the community, apart from the established board of health, and report in club meeting upon the activities of these private or philanthropic organizations. In this way the children will come to appreciate something of the value and field for individual participation in looking after the health of the group. Public boards of health are indispensable, they should come to feel, but after they have fulfilled all their proper functions there yet remain ample opportunities and necessity for charitable enterprise on the part of public-spirited citizens and societies.

3. **Finding out about local disease incidence.** Most local boards of health issue monthly statistics covering the incidence and extent of communicable and other disease during the preceding thirty days. Only relatively few citizens are aware of the type and prevalence of disease, or of the fact that exact information on the subject is available periodically from the health department. It has been the experience of most civics and hygiene teachers that older children take an absorbing and healthfully impersonal interest in the death rate and disease incidence of their own community. For a child to be taught that the mortality rate for tuberculosis, or for pneumonia, or for typhoid fever for the registration area of the United States is such and such a percent is likely to have little if any lasting impression. But for the same child to keep watch of the rates for his own city, whether for the purpose of comparing them with those of some other locality or mere informational purposes concerning home, the result is quite different. The hygiene club may well consider this absorbing topic, perhaps keeping pin-mats on the walls during the winter months, showing at a glance not only the predominating diseases of the season, but their distribution over the city as well. One group of children may work upon the problem of how to read local mortality statistics, and whether the same method of tabulation and reduction is exemplified in the state and national sta-

tistics. Another group may plot and explain curves of prominent diseases in the community. Still another group may interview the health authorities and inform the club how the department manages the mechanical side of keeping its fingers tolerably accurately and constantly upon the health pulse of the community. Finally, an enterprising team may secure all possible information as to the organization and functions of the state board of health in so far as they relate to the tabulation and publication of disease statistics. In this way the children may get some practical notion of the niceness of articulation of local with state and even with national departments.

After the first reaction of stupefaction on the part of the health officers of the city to find the growing citizens manifesting an interested concern in their work has passed, they will not only be willing but glad to render to their youthful interlocutors an account of their stewardship of the city's choicest treasure-in-store: its health. It may also result in setting them to thinking as they have never thought before upon their responsibilities and opportunities. No doubt they will be glad to furnish a speaker from their department on request who might bring to the boys and girls of the club a most interesting as well as compelling message.

4. **Investigating the city water supply.** Excellent opportunity for a field trip will be offered in the prosecution of this project. This may either be made on a holiday, or Saturday, or perhaps after school. At all events unless the reservoirs are too inaccessible every effort should be made to have the club actually visit and study them. Ordinarily the city water department will be able to supply the services of someone of its force as guide and "lecturer" for the short time which the club and teacher can devote to the actual inspection of the preserve. In the event that the system is situated too far away, or a field trip to its vicinity is otherwise infeasible, at least the lecturer should be invited to tell the club something about what a city water department means in size, extent, cost of upkeep, planning for future expansion, purification, filtration, etc., etc.

But before the club is ready for this information, it will need to investigate a little for itself. One team will find it an interesting project to learn the exact source or sources whence the city reservoirs derive their supply. Home geography may be correlated here very nicely. Another team will study the

purification and filtration processes; another the pressure and pumping systems; another the nature and location of the mains beneath the city streets; another the house-pipes, meters, shut-offs, etc. Pictures of the old Roman aqueducts—obtainable in the Perry pictures and elsewhere—will serve to add interest to the whole fascinating story of man's perennial and often herculean efforts to force pure water across great distances from an abundant source of supply to his own common habitation.

5. **Learning about the milk supply.** This is always an interesting topic to investigate. One team will set itself the task of determining roughly how much milk is required daily to meet the demands of local consumption. A second team will study the chief sources of supply of this food, together with the main routes of its importation into the city. A fourth will make a survey of the number of local distributors; the length of their routes; glaring cases of distributive duplication—such for example as when four different milk teams were noted by one child to be delivering milk daily in a single short street on which there were six houses. A fifth will inquire into the precautions required to be taken by dealers and distributors and producers in order that the purity and cleanliness of the milk supply may be safeguarded. A sixth will report upon the values and cheapness of milk as a food. Still other teams may study such related topics as Pasteurization, distribution centres, care of containers, cost of producing milk, cost of transportation, etc., etc. Ample opportunity all along the line is offered for correlation with arithmetic.

6. **Studying local methods of garbage and sewage disposal.** So far as the writer's experience goes, whatever attention so-called "hygiene" classes of the past have given to the disposal of wastes has been almost purely academic. No bigger problem, however, confronts most municipalities than the satisfactory disposal of their garbage and sewage. Study of the whole problem should occupy a recognized place in all schoolrooms where older children are taught. One team may report upon articles of food that are frequently wasted by careless housewives. Another team may compute the actual volume of garbage which the city has to remove weekly. Another team may study the workings of the reduction plant, provided the municipality maintains one, or of whatever method is employed for the final disposition of garbage. If a piggery is maintained

another team may keep track of the profit and loss side of this phase of municipal operation.

On the side of sewage, one group will study ordinary house plumbing, traps, drains, etc.; another the work of the purification plant; another the construction of sewers under the city; another the local methods of sewage reduction and final disposal; another, the financial aspect for the city. Pictures and drawings of the old Roman sewers; the reading of Victor Hugo's fascinating description of the gigantic sewers of Paris in *Les Miserables*; a field trip to the local works; and the projection upon the screen of slides obtainable from most municipal engineering departments will add much interest to the project.

7. **Finding out how diseases are spread.** This constitutes a much more valuable field of study on the part of boys and girls than does a mastery of the intricacies of the body circulations, glandular secretions, nervous pathways, etc., etc. One team may experiment elementarily with yeast as a typical bacterium; another may investigate the fascinating story of the conquest of yellow fever, thus studying a common protozoan disease; another may tabulate graphically the number of people other may report upon certain sanitary principles and precau- other may report upon certain sanitary principles and precautions to be observed in the care of the sick; another may learn about toxins and antitoxins, etc. Any number of specific contagious diseases, such as the ordinary so-called children's diseases, may be studied by different groups. One group may work out a set of "health rules" to be presented to the club for discussion and possible adoption as club mottoes, slogans, etc. Other related topics under this caption should include: care of wounds; open windows; ventilation of schools, theatres, public buildings, etc.; individual and common drinking cups; spitting in public places or in public conveyances; vaccination; outdoor sports and exercise, etc., etc. The spreading of disease is a topic broad enough to include practically everything in any way related to the activities and deliberations of any "Keep-Fit Club."

8. **Finding out about the fly nuisance.** The most favorable time of year for entering upon this project will be obviously in the spring, just at the beginning of the fly season. One team will find out how flies are able to carry about with them the

germs of disease. (There are now available excellent slides covering this whole topic.) A team will report upon the life history of the fly. The entire club membership will divide itself into teams for the purpose of investigating all possible breeding places for flies in their several neighborhoods. Subsequently some or all of them will learn about the methods of treatment of breeding sources in order to render them safe, and will actually so treat them, reporting upon their results in club meeting. Fly-traps may be constructed in manual training class and attached by the children to their own garbage pails at home. Local newspapers may be requested to give some interesting publicity to the work which the club is doing in the extermination of the common house fly. It will prove an interesting related project in arithmetic to calculate the expense which the people of the community are obliged to bear annually in the screening of their doors and windows against the fly intruder, to say nothing of the remarkable variety and array of fly-papers and poisons that clutter their homes and stores! The state boards of health will be glad to supply without charge abundant literature dealing with the whole matter of the fly nuisance. "Fly weeks" may be entered into, in conjunction with "Keep-Fit Clubs" of other schools, and the attention and interest of the entire community may be enlisted toward the possible abatement of the fly nuisance from the neighborhood.

A similar project aimed against the mosquito may be worked out by the club, and prosecuted with similar good results.

Conclusion. The foregoing projects represent only a few of a very large number of interesting and important problems—all related to the health and happiness and comfort of the community—which any enterprising school system may substitute for the old-fashioned "physiology" that used to be (and still is?) administered in generous doses to passive boys and girls. All that is needed on the part of the teacher is the conviction that these perpetual doses never have attained permanent fruit in resulting positive health attitudes in the children dosed. Wrong motives, wrong notions of educational values, and confused and mistaken educational aims have cooperated to maintain this negatively threadbare pedagogy. The writer recommends that, in place of the older practice in this regard, a practical and significant series of projects in community or per-

sonal hygiene and sanitation be inaugurated in our upper elementary and high school grades. The possible number of such projects is limited only by the ability of the teacher to conceive them and opportunity and time on the part of the children to carry them out. For the rural school too, obviously, the same possibility exists of building a course of study in hygiene that will exemplify to the children the fundamentals of rural health and interpret to them the essential facts of wise and intelligent citizenship.

Science Club Activities

SCIENCE AND MATHEMATICS ASSOCIATION OF SOUTH-WESTERN MICHIGAN

In April, 1919, the Science Club of Western State Normal, at Kalamazoo, Michigan, organized a program for Science and Mathematic teachers, for that part of the state. At one of the meetings, a committee was appointed to prepare a program for the following year, write a constitution, and effect a permanent organization. In April, 1920, the sceond meeting was held and the Association of Science and Mathematic Teachers of South-Western Michigan, was permanently organized. The meeting of this year occured at Western State Normal, April 22 and 23. The General Science Conference with H. A. Richardson as Chairman presented the following program:

1. *Should General Science do Anything to Prepare for Later Sciences?* By Fielden F. Tambling, Allegan, Mich.
2. *General Science and Community Civics.* Elizabeth Perrin, Union High School, Grand Rapids, Mich.
3. *General Science as a Means to Teach Pupils How to Study.* P. R. Moore, Dowagiac, Michigan.
4. *What Can be Done in the Way of Home Projects?* Hilda Smith, Kalamazoo, Michigan.

F. F. Tambling of Allegan, was elected Chairman of the General Science Conference, and Walter G. Marburger of Battle Creek, President of the Association, for next year.

GENERAL SCIENCE CLUB OF NEW ENGLAND

The eighth regular meeting was held in Boston on May 14, 1921, with this program.

A Musical Concert by Wireless Telephone. Clifford Kunz. Station IXE of the American Radio and Research Corporation and Station IQR of Brookline, each played for half an hour.

Aspirin or Acetylsalicylic Acid

The Journal of the American Medical Association for May 14th gives the following information regarding the name "Aspirin." This drug was patented and the trade name "aspirin" coined for it by the predecessor of the Bayer Company. The seventeen years of exclusive monopoly and privileged advertising made an impression on the minds of physicians, and also on those of laymen who had become used to seeing the word "aspirin" in physicians' prescriptions. As a result, ing the word "aspirin" in physicians' prescriptions. As a result, when the patent expired, although numerous preparations of this drug were made available under the true and descriptive name, *acetylsalicylic acid*, physicians continued to prescribe the drug under its coined name. The rights in this product were eventually acquired by the Sterling Products Company. This firm—under the name of "The Bayer Co."—has conducted a strong advertising campaign in the newspapers that leaves the impression on the lay mind that there is no satisfactory aspirin except aspirin "Bayer." Among the several manufacturers who came into the market with this drug on the expiration of the Bayer patent was the United Drug Company. The owners of the Bayer product brought suit against the United Drug Company to prohibit the selling of the latter's product under the name "aspirin." The United States District Court of Southern New York recently rendered a decision in this matter. The ruling of the court notes that acetylsalicylic acid is known as such to manufacturing chemists, pharmaceutical houses, pharmacists and physicians, so that to them the word "aspirin" signifies only the product of Bayer origin, whereas the term "acetylsalicylic acid" is unknown to the average layman, though the term "aspirin" is. The pharmacist, therefore, according to the court's ruling, is justified in supplying a layman who asks for aspirin with acetylsalicylic acid tablets of any reputable maker. But the court rules—and this is the important point—that when a physician writes "aspirin" in a prescription, only the Bayer product can be supplied. Unless a physician wishes to cater to the concern owning the Bayer rights and to aid in perpetuating what was a monopoly for seventeen years, he should be careful to prescribe the drug under the term"acetylsalicylic acid." The court now places the responsibility directly on the medical profession. Avoid "aspirin"—write "acetylsalicylic acid."

A Demonstration of Wireless Telegraphy. Clifford Kunz. International News was received from a distance of over 3000 miles from the POL Station at Nanen, Germany.

Motion Pictures for Class Room Instruction. N. Earl Pinney, Brown University.

New Experiments for General Science. Herbert F. Davison, Brown University.

A Gasoline Engine Project. J. Richard Lunt.

The following officers were elected for next year: President, J. Richard Lunt; Vice-President, H. C. Kelly; Secretary, John V. Jewett, Brookline High School; Treasurer, Ralph C. Bean. Three members of the executive committee: S. E. Marvell, Preston Smith and A. W. Taylor.

Science Articles in Current Periodicals

ACCIDENTS

When railroads kill. Lit. Dig. 69:3:20. April 16, 1921.

AERONAUTICS

Wreck of the world's largest airplane. Lit. Dig. 69:5:20. Apr. 30, 1921.

Weather experts in aeronautics. Rev. of Rev. 63:550. May 1921.

AGRICULTURE

Snow as a fertilizer. M. P. Jacques. Sci. Am. Mo. 3:315. April 1921.

Fertilizing the air. Lit. Dig. 68:1:25. Jan. 1, 1921.

Succeeding in scientific farming. R. F. Yates. Sci. Am. 124: 328. April 23, 1921

Building an orchard from a city desk. Illus. W. C. O'Kane. Gar. Mag. 35:181. May 1921.

ALASKA

What is wrong with Alaska? Illus. W. B. Greeley. Am. For. 27:198-208. April 1921.

ASTRONOMY

Misconceptions of the new giant star. Cur. Opin. 70:382. Mar. 1921

Prehistoric Astronomy. M. S. Schoernfeld. Sci. Am. Mo. 3: 301-3. April 1921.

The origin of the earth. Illus. Isabel M. Lewis. Sci. and Inv. 8:1294. April 1921.

Sunspots and the weather. Isabel M. Lewis. Sci. and Inv. 9:36. May 1921.

What does Mars look like? L. J. Wilson. Pop. Sci. Mo. 98:4:28. April 1921.

AUTOMOBILE

Touring in the auto. Illus. H. F. Johnson. Pop. Mech. 35:625. April 1921.

Automobile camp sites. Illus. M. A. Salomon. Rev of Rev. 63: 529-532. May 1921.

BATS
How bats see with their ears. Cur. Opin. 70:525. April 1921.

BIOLOGY
Creation of a blizzard-proof quadruped. Cur. Opin. 70:664. May 1921.
The Animal mind. R. L. Gamer. Sci. Am. Mo. 3:395-399. May 1921.
Imitation and evolution. R. H. France. Sci. Am. Mo. 3:400-1. May 1921.
The alternation of generation. Sci. Am. Mo. 3:405-408. May 1921.

BIRDS
Young birds and birds' eggs. Illus. R. W. Shufeldt. Am. For. 27:225-230. April 1921.

BOTANY
Why roots grow downward. H. Van Guttenberg. Sci. Am. Mo. 3:311-4. April 1921.

BRIDGES
The Hudson River bridge. Illus. Sci. Am. 124:324. April 23, 1921.

BURROUGHS
John Burroughs. Illus. Henry Van Dyke. Rev. of Rev. 63:517-9. May 1921.
The evolution of John Burroughs. Cur. Opin. 70:644. May 1921.
John Burroughs and the balance of nature. Cur. Opin. 70:667. May 1921.

CITY
Assets of the ideal city. Chas M. Fassett. Amer, City. 24:343. April 1921.
The ideal city's way of dealing with lawbreakers. C. M. Fassett. Amer. City. 24:475. May 1921.

COOKERY
No guess in gas cookery. Alice Bradley. Woman's Home Comp. 48:70. May 1921.

DISEASE
A new "torpedo" for disease germs. M. A. Mongeau. Illus. World. 35:228-231. April 1921.

DUST
Dust, good and bad. Lit. Dig. 68:1:26. Jan. 1, 1921.

DYESTUFF
U. S. Dyestuff progress. E. C. Bertolet. Com'l. Amer. 17:10:41. April 1921.

EDISON
Thomas Alva Edison. C. H. Claudy. Sci. Am. 124:230. March 19,1921.

ELECTRIC LAMPS
Renewing tungsten lamps. Illus. Frank B. Howe. Pop. Mech. 35:561. April 1921.
Manufacture of Edison Mazda lamps. Illus. E. B. Fox. Gen. Sci. Qr. 5:177. March 1921.

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Blasting with liquid oxygen. Illus. S. P. Cortland. Sci. Am. Mo. 3:333-335. April 1921.

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Putting "fireproof" to the proof. Lit. Dig. 69:1:22. April 2, 1921.

The trial of fire. Gen Sci. Qr. 5:156. March 1921.

FOOD

Detecting poisons in food substances. E. Kohn—Abrest. Sci. Am. Mo. 3:323-328. April 1921.

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25,000 boys recruited to reforest a state. H. H. Dunn. Pop Mech. 35:737. May 1921.

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Fuel conservation opinions. Sci Am. 124:368. May 7, 1921.

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Galileo. John F. Woodhull. Gen Sci. Qr. 5:70 and 133. Jan. and Mar. 1921.

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Bowling the Jack on the Green. Illus. P. Schavarzbach. Pop. Sci. Mo. 98:6:34. June 1921.

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An ideal cut flower garden. Illus. A. D. Taylor. Gar. Mag. 33:116. April 1921.

Evergreens for hedges and screens. Illus. Henry Wild. Gar. Mag. 33:124. April 1921.

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Vines for dwellings. Illus. C. L. Burkholder. Gar. Mag. 33:198. May 1921.

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Revolutionizing the glass-blowing industry. Illus. R. F. Yates. Pop. Sci. Mo. 98:30-32. May 1921.

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Preventing the roll of ships. J. F. Springer. Sci. Am. 124:308. April 16, 1921.

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Sleeping out indoors. H. Summers. Illus. World. 35:441. May 1921.

Common sense in drug control. P. W. Kearney. Amer. City 24:499. May 1921.

HOUSES

The bathrooms of today. Illus. Jessie M. Breese. Coun. Life 39: 6:66. April 1921.

The joy of hot water. Illus. Roger B. Whitman. Coun. Life 39: 6:71. April 1921.

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Man-killing insects. G. P. Paul. Sci. Am. 124:321. April 23, 1921.

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Safety features of industrial lighting. S. G. Hibben. Trans. Ill. Eng. Soc. 16:3:47-45. April 1921.

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The why of luminuos paints. M. A. Henry. Sci. Am. 124:265. April 2, 1921.

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Sentsization in bronchial asthma and hay-fever. A. H. W. Caulfield, M. D. Jo. Amer. Med. Assoc. 76:1071-8. April 16, 1921.

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National parks and the tourist. Illus. H. James. Rev. of Rev. 63:524-9. May 1921.

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How peanut butter is made. Illus. H. C. Thompson. Com'l. Amer. 17:11:33. May 1921.

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America's petroleum problem. J. O. Lewis. Jo. Fr. Inst. 191: 357-379. March 1921.

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Every cloud is a power house. L. J. Wilson. Pop. Sci. Mo. 98: 5:26-7. May 1921.

Making the most of Niagara. R. G. Skerrett. Sci. Am. 124:266. April 2, 1921.

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Hydro-electric power in Canada. Rev of Rev. 63:548. May 1921.

Pittsburgh power development. Rev. of Rev. 63:549. May 1921.

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Tapping the earth's interior for power. A. J. Lotka. Pop. Sci. Mo. 98:4:20. April 1921.

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Is phohibition making drug fiends? Lit. Dig. 69:3:19. April 16, 1921.

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SAFETY FIRST

Games save children from auto accidents. Ill. World. 34:1064. Feb. 1921.

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Sewage siphons for disposal works. W. Gavett. Amer. City. 24:504. May 1921.

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The modern cargo vessel. Illus. Wm. Gatewood. Jo. Fr. Inst. 191:331-356. March 1921.

America's merchant fleet. Ill. T. M. Knaffen. Rev. of Rev. 63:3: 285-291. Mar. 1921.

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Western Siberia and the Altai Mountains. Illus. James Bryce. Nat Geog. Mag. 39:469-507. May 1921.

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Worms that spin colored silk. H. H. Dunn. Pop. Mech. 35:17-20. Jan. 1921.

SKIS

Ski making simplified. Ill. World. 34:1089. Feb. 1921.

Magazine List

American City. The Tribune Building, N. Y. C. Monthly. $4.00 a year, 50c a copy. The science problems of city and rural communities are treated in numerous articles, well illustrated. A valuable student and teacher reference.

American Forestry. Washington, D. C. Monthly. 30c a copy, $3.00 a year. Splendid pictures for plant and tree study.

Commercial America. Phila. Com'l Museum, Phila., Pa., $2.00 a year. Ill. Commercial production. New Inventions. Will interest Commercial geography and science teachers.

Current Opinion. 65 W. 36 St., N. Y. Monthly. 35c a copy, $4.00 a year. Has a regular department "Science and Discovery" containing articles of popular interest, adapted to pupil or teacher's use.

Country Life, The New. Garden City, N. Y. Monthly. 50c a copy, $5.00 a year. Stands at the head of publications dealing with life in the country. Special interest to the general reader and has many articles on gardening and plant study valuable for school use.

Everyday Engineering Magazine. 33 W. 42 St., N. Y. Monthly. 20c a copy. $2.00 a year. Ill. Popular articles on science and mechanics Much of it is simple enough for elementary pupils.

Garden Magazine. Garden City, N. Y. Monthly. 25c a copy, $3.00 a year. Ill. Helpful to amateur gardeners, teachers and pupils.

General Science Quarterly. Salem, Mass. Quarterly. 40c a copy, $1.50 a year. The only journal published devoted alone to science in the elementary and secondary schools. It tells what schools are doing in science, gives lesson plans, demonstrations, and an extensive bibliography of usable articles in current periodicals.

The Geographical Review. Broadway at 156th St., N. Y. $1.25 a copy $5.00 a year. Devoted to scientific geography. Original maps and pictures. One department contains condensed items of topics of current interest.

The Guide to Nature. Sound Beach, Conn. Monthly. 15c a copy, $1.50 a year. Ill. Of interest to elementary pupils and teachers of nature study.

Illustrated World. Drexel Ave. and 58th St., Chicago. Monthly. 25c a copy, $3.00 a year. Many short articles on applications of science and mechanics. Popular in style and attractive to elementary and high school pupils.

Journal of the Franklin Institute. Philadelphia, Pa. Monthly. 50c a copy, $5.00 a year. Ill. A technical journal. Contains many articles of value to science teachers.

Journal of Home Economics. 1121 Cathedral St., Baltimore. Monthly. 25c a copy, $2.00 a year. For teachers.

The Literary Digest. 354 Fourth Ave., N. Y. Weekly. 10c a copy, $4.00 a year. Has a department "Science and Invention." Articles are mostly digests from other journals. They are popular in nature and suitable for high school pupils.

Journal of Industrial and Engineering Chemistry. Box 505, Washington, D. C. 75c a copy, $7.50 a year. A technical journal which contains much material which teachers can use. Monthly.

National Geographic Magazine. Washington, D. C. Monthly. 50c a copy, $4.50 a year. Best monthly journal for high grade pictures. Articles are of interest to general reader, pupils and teachers, as well as to geographers.

Nature Study Review. Ithaca, N. Y. Monthly. 20c a copy, $1.50 a year. An illustrated journal for teachers of nature study.

SKY-VAULT

The apparent form of the sky-vault. M. Luckiesh. Jo. Fr. Inst. 191:259-263. Feb. 1921.

SMOKERS

Educational research and statistics. A comparison of high school boys who smoke with those who do not. Sch. and Soc. 13: 299. March 5, 1921.

SNAKES

Are "harmless" snakes really harmless? Sci. Am. Mo. 3:14-15. Jan. 1921.

SNOW

Snow on the Overland Trail. Von C. Miner. Ill. World. 34:1014. Feb. 1921.

SOLUTIONS

A powerful new solvent. Lit. Dig. 69:2:21. April 9, 1921.

SOUND

The nature of vowel sounds. Illus. E. W. Scripture. Sci. Am. Mo. 3:361-4. April 1921.

SPEED

Swiftest things on earth. Sci. and Inv. 8:1064. Feb. 1921.

STEEL

All sorts and conditions of steel. D. A. Hampson. Pop. Sci. Mo. 98:2:92. Feb. 1921.

SUNDIALS

Quaint old sundials from foreign shores. Ill. Coun. Life. 39:5:60. Mar. 1921.

Sundial for school garden. Nat. St. Rev. 17:1:1-5. Jan. 1921.

SUBMARINE

The power of the submarine. L. W. Bates. Rev. of Rev. 63:3:277-8. Mar. 1921.

SURGERY

Steinach's surgery of rejuvenation. Cur. Opin. 70:80-84. Jan. 1921.

TESTS

Psychological Examinations. Ill. A. T. Poffenberger. Sci. Am. Mo. 3:205-211. Mar. 1921.

TEXTILE FIBERS

Nature of fibers and identification tests. Illus. Harvey G. Elledge and Alice L. Wakefield. Sci. Am. Mo. 3:421. May 1921.

TIRES

A pneumatic tire in the making. H. F. Blanchard. Pop. Mech. 35:213. Feb. 1921.

TRANSPORTATION

The case of the steam engine. C. F. Carter. Sci. Am. 124:66. Jan. 22, 1921.

Popular Mechanics Magazine. Chicago. Monthly. 25c a copy, $3.00 a year. Short science items and articles well illustrated. Appeals strongly to elementary pupils. Suggest many construction projects.

Popular Science Monthly. 255 West 39th St. N. Y. C. Monthly. $3.00 a year, 25c a copy. A Review in text and pictures of the news of science and invention presented in a humanistic and inspirational way. Used as a supplement to text-books in many high schools. Valuable to science pupils and teachers.

Review of Reviews. 30 Irving Place, N. Y., N. Y. Monthly. 35c a copy, $4.00 a year. An illustrated monthly covering world affairs. Contains many good articles bearing on science, suitable for class reports.

Safety Engineering. 80 Maiden Lane, New York. Monthly. $3.00 a year. 25c a copy. A journal devoted to conservation of life and property and contains much material helpful in science classes.

School Science and Mathematics. Chicago. Monthly. $2.50 a year. A teacher's journal. Includes many helpful suggestions.

Scientific American. Woolworth Building, N. Y. Weekly. 15c a copy, $5.00 a year. Has longer articles than the other popular science journals. Illustrated and is particularly valuable to high school science pupils and teachers.

Scientific American Monthly. Woolworth Building, N. Y. Monthly. 60c a copy, $7.00 a year. Rather technical, but the majority of articles are usable by science teachers and some of them will do for pupil reference. Illustrated.

Science and Invention. 233 Fulton Street, N. Y. Monthly. 25c per copy, $3.00 a year. Ill. Popular articles on astronomy, physics, photography, radio-activity, medicine, and in fact, science in general.

Scientific Monthly. Garrison, N. Y. 30c a copy, $3.00 a year. Articles as a rule are more along lines of pure science. Much of value to teachers. Articles can be read to advantage by many pupils.

Transactions of the Illuminating Engineering Society. 29 W. 39th St., N. Y. Monthly. 75c a copy, $5.00 a year. Technical. Many articles contain material which can be used in high school classes.

Woman's Home Companion. 381 Fourth Ave., N. Y. C. Monthly $2.00 a year. Good articles on foods and homes.

TURBINES

Steam turbines for municipal power plants. W. F. Schaphorst. Amer. City. 24:361. April 1921.

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Famous and interesting trees. Illus. James Ricalton. Am. For. 27:217:224. April 1921.

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The chemistry of vitamines. A. Seidell. Jo. Ind. and Eng. Chem. 13:72. Jan. 1921.

WATER

Water waste restriction in Boston. Amer. City. 24:392. April 1921.

Water softening for the manufacture of raw water ice. A. S. Behrman. Jo. Ind. and Eng. Chem. 13:235. Mar. 1921.

WATER POWER

Developing one million horse power from tidal energy. Sci. Am. 124:67. Jan. 22, 1921.

WATER SUPPLY

The effect of different waters on mains. J. E. Gibson. Am. City. 24:2:159. Feb. 1921.

Water supplies and the typhoid rate. H. W. Clark. Am. City. 24: 2:171. Feb. 1921.

WEATHER

"The devil's handkerchief is up;" Hurricanes. Illus. J. A. Morgan. Illus. World. 35:427. May 1921.

Our climatic travels. Lit. Dig. 69:4:20. April 23, 1921.

Forecasting path of hurricanes in Gulf of Mexico. H. H. Dunn. Pop. Mech. 35:377. Mar. 1921.

Science and the weather man. Ill. Sci. and Inv. 8:968-9. Jan. 1921.

WINTER SPORTS

Up the mountain on skis. Ill. Fred H. Harris. Country Life. 39: 4:48-50. Feb. 1921.

The ski runner's outfit. Ill. Dwight Franklin. Coun. Life. 39:4: 54-6. Feb. 1921.

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Wireless in Print. Lit. Dig. 68:12:29. March 19, 1921.

New wireless wonders. Rev. of Rev. 63:551. May 1921.

WOOD

The lightest wood in the world. Lit.Dig. 69:5:23. April 30, 1921.

Phenomena of drying wood. H. D. Tremann. Jo. Fr. Inst. 189:645. May, 1920.

X-RAY

The X-ray detective. Ill. G. Vanderveer. Sci. Am. Mo. 3:261. Mar. 1921.